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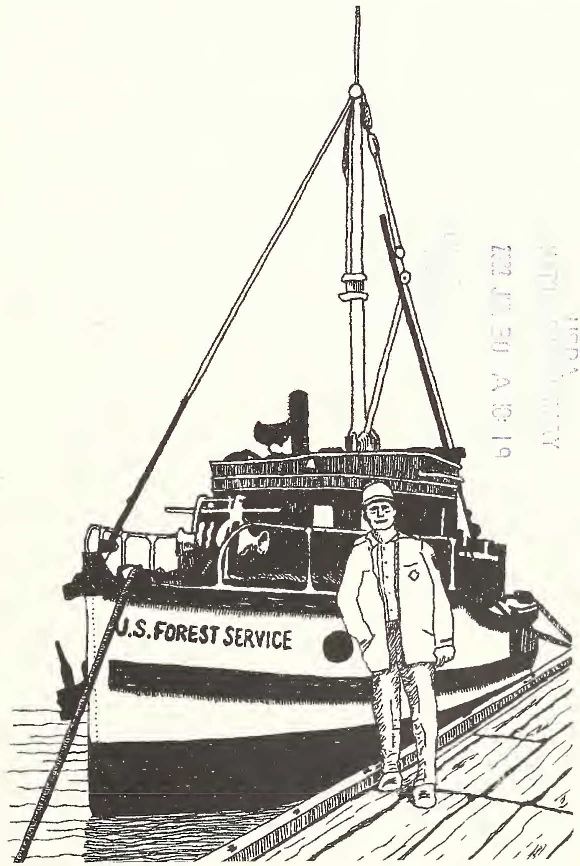
Revised Land and Resource Management Plan

Final Environmental Impact Statement

Chapters 1-6



Chugach National Forest

Final Environmental Impact Statement Chugach National Forest Land Management Plan Revision

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Final Environmental Impact Statement
Chugach National Forest
Land Management Plan Revision

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Preface

A Reader's Guide to the FEIS

This Final Environmental Impact Statement (FEIS) is organized into a preface, six chapters (Volume I) and twelve appendixes (Volume II). A packet of alternative maps accompanies the document. The Revised Forest Plan (separate document) is a representation of the Preferred Alternative in the FEIS, as modified by the Record of Decision.

Preface - This section briefly describes the contents of each chapter and appendix in the FEIS (listed below). It also gives a brief history of forest planning and summarizes the development of the Revised Forest Plan and FEIS.

Chapter 1 - "Purpose and Need" describes the rationale behind forest plan revision. It explains the need for change and discusses the issues and concerns raised by the public. The decisions to be made in the Revised Forest Plan are described.

Chapter 2 - "The Alternatives" describes the process used to develop alternatives, lists important points common to all alternatives, describes the eight alternatives, and identifies the preferred alternative. Alternatives initially considered then eliminated from detailed analysis are briefly discussed. The effects of the eight alternatives on major topics are summarized.

Chapter 3 - "Environment and Effects" describes current conditions on the Chugach National Forest and the consequences of implementing each alternative, with a focus on the situation statements and effects.

Chapter 4 - "List of Preparers" lists those instrumental in writing the documents.

Chapter 5 - "List of Recipients" lists those who received copies of the FEIS and the Revised Forest Plan.

Chapter 6 - "Public Participation and Comment on the DEIS and Proposed Revised Forest Plan" describes the content analysis process and summarizes public comments on the DEIS and Proposed Revised Forest Plan.

References - This section lists the references cited in the FEIS.

Glossary - A glossary of terms provides definitions of technical and legal terms.

Appendixes - Appendixes provide additional information and detail on subjects addressed in the FEIS.

Appendix A - Situation Statements

Appendix B - Description of the Analysis Process

Appendix C - Roadless Areas

Appendix D - Wild and Scenic Rivers Evaluation

Appendix E - Silvicultural Systems

Appendix F - Access Management Plan

(also see Revised Forest Plan, Appendix B, Roads Analysis and Access Management Plan)

Appendix G - Biological Assessment

Appendix H - Alternative Descriptions

Appendix I - Oil and Gas Leasing Stipulations

Appendix J - Management Prescription Activity Matrixes

Appendix K - Public Comments and Forest Service Responses

Appendix L - Vascular Plant Species Richness

Map Packet - Alternative Maps - No Action, Preferred, A, B, C, D, E, and F

Development of the Revised Forest Plan and EIS

Brief History of Forest Planning

Current forest planning regulations are an extension of historic Forest Service experience in land management planning. For many years the Forest Service has prepared plans to guide inventory development, identify special management areas, calculate sustainable use levels, and monitor resource conditions and trends. The planning process has evolved over time and increased in complexity in response to increasing demands for forest resources, changing desires and expectations of the American public, and changes in the legal statutes regulating federal land management activities.

Planning on National Forest System lands is currently governed by several key pieces of federal legislation: the Multiple-Use Sustained-Yield Act of 1960; the National Environmental Policy Act of 1969 (NEPA); the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA); and, the National Forest Management Act of 1976 (NFMA).

The Multiple-Use Sustained-Yield Act requires management of the National Forest System lands to ensure coordination of multiple uses and a continued supply of goods and services for the American people. The broad multiple use categories under this act are outdoor recreation, range, timber, watershed, and wildlife and fish.

The National Environmental Policy Act (NEPA) incorporates environmental analysis and public participation into the land management planning process. The NEPA process is intended to help public officials make decisions based on

an understanding of environmental consequences and take action to protect, restore, and enhance the environment. The process also ensures that environmental information is made available to public officials and citizens before decisions are made and actions are taken. Implementation of NEPA requires accurate scientific analyses, expert agency input, and public review.

The Forest and Rangeland Renewable Resources Planning Act (RPA) provides a comprehensive framework for planning on the national forests. While enactment of the RPA did not substantially alter planning procedures, it did make the development and maintenance of Land and Resource Management Plans a legal requirement. The National Forest Management Act (NFMA) amended the RPA in 1976.

The enactment of the National Forest Management Act (NFMA) provided additional legal direction for forest planning. Regulations for implementing NFMA were developed in 1979 and updated in 1982 (36 CFR 219). The 1982 regulations detail the specifics of the forest planning process. Analytical and procedural requirements for development, revision, and significant amendment of forest plans were established. Requirements for monitoring and evaluating forest plan implementation were set. The Chugach National Forest's 1984 Forest Plan is being revised under these regulations.

Under NFMA, procedures for formulating and evaluating alternatives are described, and the alternatives are required to represent a full range of resource outputs and expenditure levels.

The Chugach National Forest's first Plan was issued in 1984 and NFMA regulations state that forest plans should be revised on a 10-year cycle or at least every 15 years.

Steps Taken in the Development of the Revised Plan and EIS

In June 1992 the Chugach published an "Evaluation Report of the Implementation of the Chugach National Forest Plan" (USDA Forest Service 1992c). This report is a review of the conditions on the land covered by the plan to determine whether conditions or demands of the public have changed significantly. Beginning in FY 1993 annual Forest Plan Monitoring and Evaluation reports were published. NFMA regulations require a monitoring and evaluation program on each forest. The objective of the program is to ascertain how well the current forest plan is performing.

The Analysis of the Management Situation (AMS) was published in April 1998 and is incorporated by reference into this FEIS (USDA Forest Service 1998b). The AMS determines the Forest's ability to supply goods and services in response to public demand, based on past and present land uses and current management direction. The AMS evaluates how well the 1984 Forest Plan addresses critical issues or revision topics. It also provides a basis for formulating a broad range of reasonable alternatives. A list of preliminary alternatives was included in the AMS.

A Notice of Intent to revise the Forest Plan and prepare an EIS was published in the Federal Register in April of 1997. In May of 1997, the Forest distributed the first volume of the "Revision Newsletter" to help determine if public demands have changed since the inception of the Forest Plan. In the fall of 1997, the Forest Service held a series of collaborative learning workshops in various communities in the vicinity of the Forest to identify public interests, conflicting interests and the potential for making improvements in conflict situations under the direction of the 1984 Forest Plan. As a result of the workshops and the mailing of the newsletter the Chugach National Forest received over 3,000 comments.

Over the course of two months all comments were reviewed, analyzed and summarized to identify 24 important interests of people who use the Chugach National Forest. Some public interests were in conflict with each other, such as motorized recreation vs. nonmotorized recreation, and were characterized as "situations." Six situations were identified and formed the basis for alternatives. They included:

- Ecological Systems Management;
- Habitat for Fish and Wildlife;
- Resource Development;
- Recreation/Tourism;
- Recommendations for Administrative and Congressional Designations; and,
- Subsistence.

On December 20, 1999, the Forest Supervisor approved the range of alternatives to be analyzed in detail in the DEIS. Alternatives A - F and the existing, No Action, alternative were to be analyzed in detail. Alternatives 6 and 13 were also included in the DEIS but not analyzed in detail. This represents the culmination of a period of intense activity both on the part of the public and the Interdisciplinary Team (ID Team), which developed an initial set of 30 alternatives and then reduced those to nine (Alternatives A – F, 6, 13, and the No Action Alternative). From these nine alternatives the Preferred Alternative was developed. Alternatives are described in detail in **Chapter 2** of this document. By design, each alternative represents a potential forest plan that meets legal and administrative requirements and that can be implemented if selected.

The next step in the revision process was to evaluate the environmental consequences of each alternative. A summary of these effects is presented in **Chapter 3** of this document. For each forest resource, resource specialists described its existing condition and discussed how the alternatives would affect the resource.

A DEIS and Proposed Revised Forest Plan was released for public review on September 15, 2000. During the 90-day comment period over 33,000 comments were received. After analysis and review of these comments by the ID Team, the

DEIS Preferred Alternative was modified. The resulting modified Preferred Alternative was analyzed and is displayed in this FEIS.

Summary of Changes in the FEIS

Following are a summary of changes made to the DEIS.

- The following table reflects changes that were made in Management Area prescriptions for the Preferred Alternative:

Management Area Prescription [1]	DEIS Preferred	FEIS Preferred
111 Primitive	11,750	11,750
121 Wilderness Study Area	0	0
131 Recommended Wilderness	1,352,730	1,413,350
132 Wild River	9,590	12,180
133 501(b) - Recommended Wilderness	449,210	442,490
135 501(b) - 1	0	445,170
141 Research Natural Area	23,730	23,730
210 Backcountry*	0	1,818,890
211 Backcountry	1,435,220	0
212 Backcountry Motorized	373,150	0
213 501(b) - 2	1,073,990	660,940
221 EVOS Acquired Lands	102,040	102,040
231 Scenic River	115,630	14,270
241 Municipal Watershed	970	960
242 Brown Bear Core Area	73,090	70,360
244 Fish and Wildlife Conservation Area	229,720	260,640
312 Fish, Wildlife and Recreation	182,630	159,820
313 Backcountry Groups	0	0
314 Forest Restoration	20,770	20,770
321 501(b) - 3	6,700	15,380
331 Recreational River	6,000	6,080
341 Developed Recreation / Reduced Noise	11,900	0
411 Resource Development	0	0
441 Developed Recreation Complexes	0	0
521 Minerals (site specific)	6,860	6,860
522 Major Transportation / Utility Systems (site specific)	5,900	5,900
Total Acres	**5,491,580**	**5,491,580**

[1] Note: Two new management prescriptions were developed for the modified Preferred Alternative:
1. 135 501(b) - 1: A new Wilderness-like management area prescription for the Copper River Delta – east.
2. 210 Backcountry*: A management area prescription that combines the 211 Backcountry and 212 Backcountry Motorized management area prescriptions. Motorized/Nonmotorized use is dealt with outside the prescriptions (see Chapter 3, Access Management).

- The following changes were made in Wild and Scenic River recommendations:
    - Dropped: Martin Creek, Portage Glacier, Columbia Glacier
    - Added: Russian River
- The budget allocations were updated
- The Recreation and Tourism sections, throughout the document, were rewritten
- Significant additional analysis was completed for:
    - Biodiversity
    - Aquatic Systems
    - Forest Vegetation
    - Wildlife
    - Social and Economic
    - Appendix F - Access Management Plan – several changes were made in the road, trail and route management for the Preferred Alternative
- The following Appendixes were added:
    - Appendix G – Biological Assessment
    - Appendix K – Public Comments and Forest Service Responses
    - Appendix L – Vascular Plant Species Richness
- Other minor additions and corrections were made and are reflected in the FEIS and Revised Forest Plan in response to public comment and ID Team review.

Chapter 1–Purpose and Need

Chapter 1 – Purpose and Need

The Purpose of and Need for Action

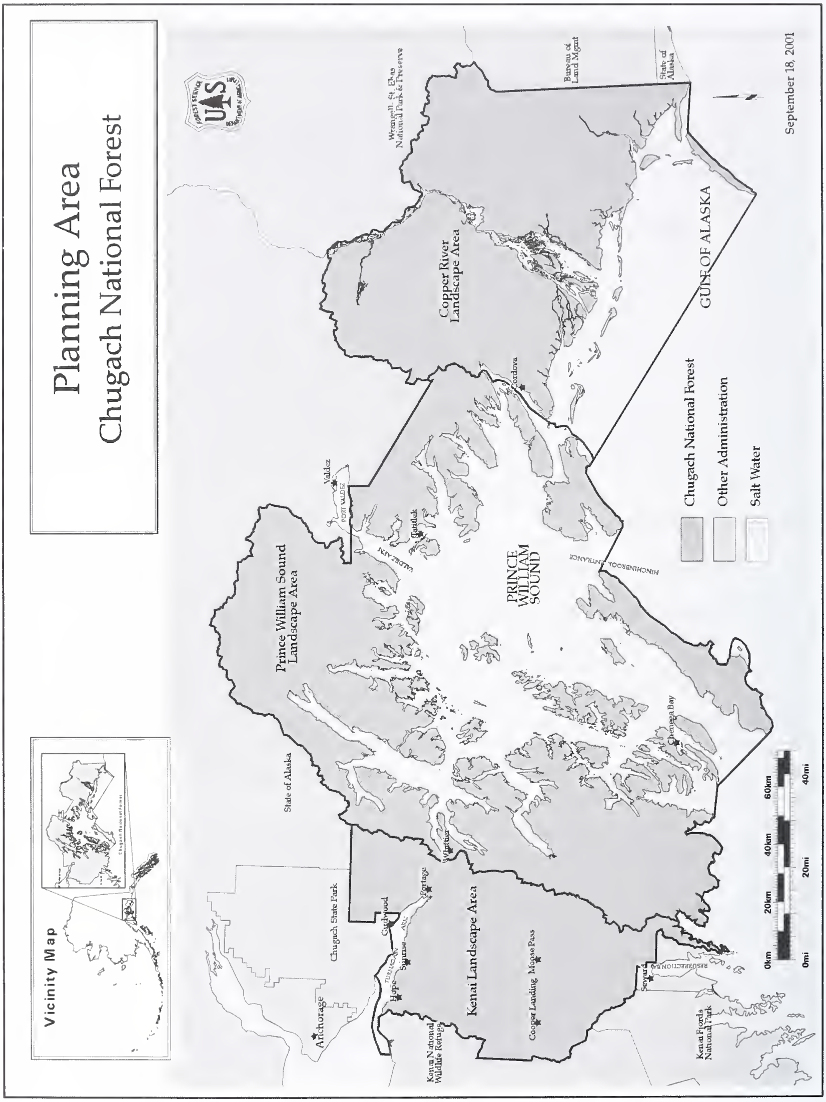
The purpose of this proposed action is to develop a Revised Chugach National Forest Land and Resource Management Plan which will guide natural resource management activities on the Forest for the next 10 - 15 years and meet the objectives of federal law, regulation, and policy. The proposed action also includes adoption of a project-level, site-specific access management plan, which identifies access opportunities and restrictions for Forest roads and trails. The implementing regulations for the 1976 National Forest Management Act (NFMA) require that each Forest Supervisor develop a forest plan (36 CFR 219.1) and revise it at least every 10 - 15 years (36 CFR 219.10(g)). An environmental impact statement (EIS) documenting the environmental analysis for this revision is required by NFMA (36 CFR 219.10(b)). The 1984 Chugach National Forest Land and Resource Management Plan (1984 Forest Plan) and Final Environmental Impact Statement were completed on July 27, 1984 (USDA Forest Service 1984a, USDA Forest Service 1984b). The 1984 Forest Plan has been amended five times (USDA Forest Service 2000a).

Planning Area

The planning area encompasses the entire 5.45-million acre Chugach National Forest located in Southcentral Alaska (see Figure 1-1). The Chugach is the second largest forest in the National Forest System and is subdivided into three administrative units: the Glacier, Seward, and Cordova Ranger Districts. One-third of the Chugach National Forest is rock and moving ice. The remainder is a diverse and majestic mixture of land, water, plants, and animals. Diversity is what makes the Chugach so unique. The mountains and water of the Kenai Peninsula, the islands and glaciers of Prince William Sound, and the wetlands and birds of the Copper River Delta make the Chugach a destination for adventurers the world over.

The planning area contains 96 watersheds that generally follow major drainage divides within three broad geographic areas: Kenai Peninsula, Prince William Sound and Copper River Delta. Communities located within the project area include Whittier, Hope, Seward, Cooper Landing, Moose Pass, Tatitlek, Chenega Bay, and Cordova, Alaska. Adjacent to the project area are the communities of Anchorage, Valdez, Sterling, Kenai, and Soldotna. The Chugach National Forest is bordered to the west, on the Kenai Peninsula, by the Kenai National Wildlife Refuge and the Kenai Fjords National Park; to the north, near Girdwood, by the Chugach State Park; to the northeast, near the Copper River Delta, by the Wrangell-Saint Elias National Park and Preserve and, to the east Bureau of Land Management lands.

Figure 1-1: Planning area.



Need to Change and Rationale

Regulations implementing the NFMA (36 CFR 219) require the Regional Forester to make revisions to forest plans and provide the basis for proposed changes within the context of regulatory requirements. In 1997, the Regional Forester determined that the 1984 Forest Plan needed to be revised. This need for change was based on an assessment of current management direction, new information, new laws and policies, resource supply potentials and projections of demand, the results of monitoring and evaluation, and the identification of public issues and management concerns (USDA Forest Service 1998b).

Multiple-use Goals and Objectives

The goals and objectives of the 1984 Forest Plan were developed in 1984 and have not been updated. National forest management is dynamic, and changes in public views, resource uses and demands, and natural resource knowledge require periodic re-evaluation of multiple-use goals and objectives.

Inventory information concerning the Forest's land and water resources is more accurate than it was in 1984. The Forest now has a geographic information system (GIS), which greatly enhances the Forest Plan revision process by incorporating the most current information available on the Forest.

Scientific knowledge of physical and biological processes occurring on the Forest has improved in recent years. New or emerging knowledge and techniques in the areas of biological diversity, recreational trends, and public opinion polling make revision of the 1984 Forest Plan a timely matter.

Management Prescriptions

The 1984 Forest Plan uses 22 broad analysis area designations to allocate land uses to different types of management (such as primitive recreation or emphasis on wildlife habitat). More specific management prescriptions have become the standard in more recent Forest Plans.

Standards and Guidelines

Forest standards and guidelines specify how projects and activities are to be carried out to satisfy multiple resource needs. Several new issues, such as ecological sustainability, subsistence, natural quiet, and potential designation of Wild and Scenic Rivers, have emerged in the revision processes that were not addressed in the 1984 Forest Plan. Forest Plan revision provides an opportunity to add new standards and guidelines for these issues in addition to updating existing standards and guidelines.

Timber

Under the 1984 Forest Plan, lands were made available for a variety of uses including timber production. The 1984 Forest Plan established an average allowable sale quantity (a decadal ceiling on the amount of timber that can be supplied) of 16.9 MMBF per year. This quantity was designed to meet projected market demands in Southcentral Alaska and to contribute to the economy while meeting multiple-use resource goals.

In the 1986 settlement agreement to the 1984 Forest Plan appeal, the allowable sale quantity was amended to 6.3 MMBF per year for the first 5 years and 10.6 MMBF per year for the remaining 5 years of the Forest Plan. The actual volume harvested during the last five years (1996-2000) averaged only 1.5 MMBF per year.

With market demand for Southcentral Alaska's timber expected to remain low during the net 10-15 years and in response to public issues, a reduction in the current allowable sale quantity needs to be considered since the amended 1984 Forest Plan allowable sale quantity objectives were not achieved.

Public Issues

Professional and public concern for the potential loss of species throughout the world is accelerating. Concerns also have mounted regarding the spruce bark beetle epidemic on the Kenai Peninsula, the management of roadless areas, and other issues. In addition, increasing levels and new types of recreational use on the Forest call for new management approaches to address issues of public access, conflicts between uses, and protection of the environment.

New Laws and Policies

Finally, newly created or changed laws and policies affect Forest Plan content and Forest management. Examples include the Oil and Gas Leasing Reform Act of 1987, the 1987 Clean Water Act, and the Clean Air Amendments of 1990.

After examining the 1984 Forest Plan, the Forest Supervisor concluded that many of the existing Forestwide goals and objectives, standards and guidelines, and management area prescriptions needed to be considered for change and, therefore, recommended to the Regional Forester that the 1984 Forest Plan be revised. A Notice of Intent to prepare an environmental impact statement to revise the 1984 Forest Plan was published in the *Federal Register* on April 21,1997.

Situation Statements (Significant Issues)

"Situation statements" represent where public "interests" are in conflict or where existing conditions could be improved by changing the 1984 Forest Plan. Situation statements identify major issues, concerns and interests that can be addressed through management area prescriptions. Management area prescriptions reflect different ways of managing land. Those issues, concerns and interests were developed from comments received during the scoping period.

Six situation statements were determined to be significant and are the focus of the Forest Plan revision. These situation statements are addressed through the proposed action and alternatives. Key indicators that were used to determine how well the alternatives respond to the situation statements were identified. Other resources were analyzed for change through adjustment of standards and guidelines or management area prescriptions.

Each situation statement has environmental, social and economic implications. Environmental implications relate to the fundamental integrity of the physical and

biological aspects of the Forest environment and surrounding area. Social implications relate to the people who use the Forest or whom Forest management directly affects. Economic implications relate to the people, businesses and government agencies that rely on the Forest for income or livelihood.

In each alternative, the situation statements are addressed in the context of ecosystem management. Ecosystem management is the tool that the Forest uses to address and integrate the environmental, social, and economic implications of these topics. Next, the situation statements, their associated environmental, social and economic implications, and the key indicators (measures) of how each topic will be addressed are discussed.

1. Ecological Systems Management

In 1992, the Chief of the Forest Service provided direction for the agency to implement the practice of ecosystem management. Its goal is to produce diverse, healthy, productive and sustainable ecosystems under an operating philosophy based on environmental sensitivity, social responsibility, economic feasibility and scientific principles. Maintaining biodiversity is a critical component of ecosystem management. Biological diversity (biodiversity) refers to “the full variety of life in an area, including the ecosystems, plant and animal communities, species and genes, and the processes through which individual organisms interact with one another and their environments” (USDA Forest Service 1992b).

Public scoping comments in 1997 indicated that some people think ecological conditions on the Forest have declined (e.g., spruce bark beetle epidemic, etc.) and that active management can restore sustainability by providing a greater diversity and balance of ecological types on the Forest. They suggest that management can bring back a green-forested appearance and forest diversity to the Kenai Peninsula. They are interested in a forest condition that can support forest products uses and recreation uses in the future along with associated employment opportunities.

Others think that sustaining ecosystems on the Forest can best be accomplished by allowing natural processes to operate without disruption by humans. These interests are in natural appearing landscapes, maintaining plant and animal populations (particularly brown bears) through preservation of habitat and maintaining the intrinsic value of natural evolving ecosystems. They also have interests in employment, but feel that maintaining ecosystems in natural conditions will provide the most sustainable employment opportunities.

The following are key indicators for Ecological Systems Management:

- changes in the regional landscape;
- changes in land cover, vegetative cover and forest structure;

- bioenvironmental classes (generalized climate, vegetation and landforms);
- wildlife species richness by prescription category; and,
- wildlife species richness by land cover class and habitats of interest.

2. Habitat for Fish and Wildlife

Fish and wildlife provide major subsistence, commercial, recreational, and traditional and cultural values on the Forest. Maintenance of the habitat supporting wildlife populations is a focal point for public, state and federal natural resource agencies, as well as user groups, Native organizations and individuals.

Some people feel active habitat enhancement projects such as fish ladders or prescribed burns are appropriate or even necessary for sustaining or improving fish and wildlife populations. Some feel that no active enhancement is necessary and natural processes should prevail. Others feel that other land management activities, such as timber harvest or road building, can be accomplished without harming fish and wildlife habitat or can be mitigated with enhancement projects.

Conservation of brown bears is a specific concern on the Kenai Peninsula. Some people feel that active management can take place on the Kenai Peninsula, with adequate mitigation, and still conserve brown bears. They think relying on natural processes to conserve brown bears unnecessarily restricts other Forest activities (e.g., timber harvest, recreation development, etc.).

Other people felt that allowing natural processes to operate without disruption by humans could best conserve brown bears. They are concerned that development such as timber harvest, roads and trails, and recreation use could detrimentally affect the conservation of brown bears.

The following are key indicators for Habitat for Fish:

- percentage of coho and pink salmon by prescription category;
- acres and miles of improved aquatic habitat; and,
- amount of disturbance by timber harvest.

The following are key indicators Habitat for Wildlife:

- habitat for management indicator species, species of special interest and threatened, endangered and sensitive species; and,
- distribution of wildlife habitat for management indicator species, species of special interest and threatened, endangered and sensitive species.

3. Resource Development

Forest Products

Many people gather firewood from the Forest for heating and cooking. Others have built their homes from logs taken from the Forest. Still, other people collect berries and other plants for subsistence use in addition to moss, cones, conks, boughs, seedlings, saplings, and poles for a variety of other uses.

Historically, the Forest has sustained a commercial timber industry since the early 1900s when timber was harvested for mining timbers, firewood, and home construction, followed by railroad ties during construction of the Alaska Railroad. Today, a small commercial industry exists which over the last five years has harvested an average of 1.5 million board feet per year, mostly on the Kenai Peninsula.

People expressed an interest in obtaining a variety of forest products for uses ranging from personal use to creating business opportunities, employment, community stability and maintaining traditional lifestyles in resource production occupations. Some people would like to see the Forest make more timber for commercial forest products available while others only saw a need to supply personal use forest products. Still, others would like to see no use of products from the Forest.

The following are key indicators for Forest Products:

Suitable Timberlands Scheduled for Chargeable Timber Harvest

- estimated average annual demand for commercial forest products;
- acres of suitable timberlands allocated for timber production by prescription category and management area prescription; and,
- annual allowable sale quantity from suitable timberlands (chargeable board/cubic foot volume of sawtimber and utility volume).

Unsuitable Forestland Planned for Nonchargeable Timber Harvest

- estimated average annual demand for personal and free use forest products;
- annual acres of unsuitable forestland planned for vegetation management by small commercial, personal and /or free use timber harvest; and,
- annual total board/cubic foot volume of nonchargeable forest products (sawtimber, poles, cabin logs, firewood) available for small commercial, personal, and/or free use.

Minerals

Historically, mining is one of the oldest commercial uses of the Forest. Today, most of the Forest is available for mineral exploration and mining unless specifically precluded by an act of Congress or other withdrawal.

The exploration and production of locatable, leasable, and saleable minerals on the Forest is important to many people. Some people expressed an interest in not allowing any mining or minerals development on the Forest while others prefer to not allow any new mining claims on the Forest while recognizing existing claims. Other people would like to see more areas withdrawn from mineral entry, while others would like to see more opportunities on the Forest for recreational gold panning. Finally, some people expressed a desire to see all areas of potential mineralization left open for exploration and possible development.

The following are key indicators for Minerals:

- acres open to locatable mineral entry;
- past and current mining claims;
- active mining operations;
- active mineral material sites;
- acres available for oil and gas leasing; and,
- reasonably foreseeable development for oil and gas production.

4. Recreation and Tourism

Recreation and tourism is how people directly experience the spectacular natural scenery of the Chugach National Forest. Rugged mountain ranges with slopes and glaciers that tumble to the sea; fish runs so abundant that any angler can catch a big one; watchable wildlife such as brown bears, moose, bald eagles, whales, and sea otters; seabird concentrations that may be unrivaled anywhere else north of the Everglades; and old growth temperate rainforest scattered on a string of islands and coastal lands--all make the Chugach National Forest an outstanding recreational setting.

Yet the very features that make the Chugach National Forest so outstanding may also limit recreational opportunities. Much of the Forest is covered with steep mountains, glaciers, icefields, or icy-cold saltwater. People must have well-developed outdoor adventure skills such as backcountry skiing, sea kayaking, and mountaineering, or use modern technology such as snowmachines, helicopters, and motorized boats to access this rugged, remote, and often unforgiving terrain. Frequently a combination of both approaches is needed to fully enjoy the Chugach National Forest.

As a result, “mainstream” recreational opportunities on the Chugach National Forest are concentrated along the few road corridors and accessible shorelines

that people can easily reach. Crowding and some conflicts among recreationists are increasing in such areas. Recreation and tourism is projected to increase in Southcentral Alaska due to overall population growth. Patterns of recreation may also change over time due to changes in demographics, such as the aging of the U.S. population, and changes in access, such as construction of road access to Whittier. Balancing projected demand, the desires of different user groups, and the land's capacity is the central dilemma --how do we continue providing high quality recreation opportunities in a way that conserves the Forest's unique natural landscape for future generations?

Recreation Settings

The goal of most recreationists, whether resident or visitor, is to have a positive experience by engaging in outdoor recreation activities. Forest managers cannot provide recreation experiences, but they can provide the settings for these experiences to be realized. Recreation settings in this context are the physical places in which a variety of recreation activities occur. Participating in activities in appropriate settings creates a user's recreation experience and consequent level of satisfaction. Matching one's desired experience with a setting that can allow the realization of that experience is the key to a satisfactory, positive recreation experience. The Chugach National Forest provides a variety of recreation settings, from primitive to highly developed, in a complex diversity of landscapes. This continuum of settings is described by the Recreation Opportunity Spectrum.

Key Indicators for Recreation Settings

- Difference among existing and proposed Recreation Opportunity Spectrum (ROS) classes, by alternative;
- Comparison of relative distribution of ROS classes, among alternatives.

Recreation Use

Recreation use is a measure of the number of people participating in a given activity or using a given site. Recreation occurs at constructed, developed sites or in the general forest area, sometimes called dispersed areas or the backcountry. As part of the analysis of recreation supply and demand, use levels are projected into the future to provide an estimate of demand. Currently, the demand for campgrounds and cabins exceed the available capacity. Future demand can then be compared to each alternative's proposed recreation capacity or supply in developed infrastructure (roads, trails, campgrounds, and other facilities) as well as in dispersed areas.

Key Indicators for Accommodating Recreation Use

- Comparison among existing developed infrastructure and capacity and the alternatives' proposed developed infrastructure and capacity;
- Comparison among existing dispersed recreation capacity and the alternatives' proposed dispersed recreation capacity.

User Group Conflicts

Because the terrain and the infrastructure on the Chugach National Forest concentrate people on to a relatively small part of the overall land base, conflicts among different user groups have developed over the issue of access to desirable recreation settings. This issue is most intense on the Kenai Peninsula, which is within an hour's drive of half of Alaska's population and hosts two-thirds of all visitors to Alaska. The Kenai also has the most developed road, trail, and facility infrastructure, compared to Prince William Sound and the Copper River Delta. Conflicts over access are focused on:

- Motorized and nonmotorized recreation in the winter and summer, including snow machining, heli-skiing, cross-country skiing, and natural quiet;
- Need for additional recreation access in both winter and summer.

Key Indicators for Responding to User Group Conflicts

- Comparison of strategies used by alternatives to respond to user group conflicts, in each geographic area (Kenai Peninsula, Prince William Sound, Copper River Delta).

5. Recommendations for Administrative and Congressional Designations

Public interest in special designations, such as Research Natural Areas (RNAs), Wilderness, and Wild and Scenic Rivers, is strong and passionate. There is disagreement over the interpretation of the Alaska National Interest Lands and Conservation Act (ANILCA). Some feel that there are already enough conservation system units in Alaska and that additions would violate the intent of ANILCA. Some feel that ANILCA does not limit or restrict further study or recommendation of a conservation system unit. Others expressed an interest in protecting ecosystems through special administrative (Forest Service) action and congressional designations (law). These designations are viewed as providing long-term protection to ecosystems and providing primitive recreation opportunities. Still others expressed concern that any designations could exclude resource development, affect existing uses, and limit access and private property rights.

The following are key indicators for recommendations for administrative and congressional designations:

- acres recommended for Wilderness designation;
- number and miles of rivers recommended for Wild and Scenic Rivers designation; and,
- number and acres of proposed and existing RNAs.

6. Subsistence

ANILCA requires the Forest Service to consider the effect of any management activities on subsistence. Subsistence is an important part of the rural Alaskan lifestyle. People in the rural communities of Chenega Bay, Cordova, Tatitlek, Whittier, Hope, and Cooper Landing, and others outside the Forest partake in a variety of subsistence activities on the Forest. Subsistence can provide cultural, spiritual, personal, and sustenance value. People typically take fish, wildlife and plant material for subsistence. Traditional native values and beliefs are centered on their relationship with the animals and plants in the world around them. Natives remain socially, economically, and spiritually intertwined with their subsistence heritage.

People have indicated that maintaining subsistence opportunities is important. They are concerned that activities such as timber harvest, road building, and recreation development could impact fish and wildlife populations or increase competition for subsistence resources. They are concerned about maintaining traditional access to subsistence resources and are concerned about special designations that may limit their access. They are also concerned about fishing and hunting competition with urban users and about displacement from use areas because of conflicts with non-consumptive users.

The following are key indicators for Subsistence:

- habitat capacity and management intensity that would affect species important to subsistence;
- acres of habitat where traditional access is not limited;
- miles of new road construction; and,
- number of backcountry sites.

Other Issues and Concerns

Some interests did not meet the criteria for being considered significant, but were nevertheless analyzed for changes through adjustment of standards and guidelines, management area prescriptions, or procedural adjustments and appear in the Revised Forest Plan. Examples include the topics of air, water, and soil resources, landownership and special uses.

A number of other interests and issues raised by the public and other agencies are not addressed in alternatives or situation statements. These interests may

require a solution that is outside the scope of the Forest Plan. If the topic is not resolvable under one of those decisions, it is better handled in another process. Other topics are best handled legislatively, by other responsible agencies, or as a result of further research.

Decisions to Be Made

Forest Plan

Based on the environmental analysis in the Final Environmental Impact Statement (FEIS) for the Revised Forest Plan, the Regional Forester will decide to approve or disapprove adoption of the Revised Forest Plan in accordance with 36 CFR 219.10. The adoption of a forest plan establishes key decisions for the long-term management of a national forest. These decisions are:

1. Forestwide multiple-use goals and objectives, including a description of the desired condition of the Chugach National Forest;
2. Forestwide standards and guidelines;
3. Management areas and management area prescriptions;
4. Identifying lands administratively available for oil and gas leasing and the stipulations that must be applied to specific lease areas and lands the Bureau of Land Management is authorized to lease;
5. Monitoring and evaluation requirements for implementation of the Revised Forest Plan;
6. Identifying land suitable for timber and establishing timber harvest levels from suitable timberlands;
7. Recommending areas for Wilderness classification; and,
8. Identifying rivers eligible for Wild and Scenic River consideration and recommendation of suitable rivers for inclusion in the Wild and Scenic River System.
9. Identifying lands open or closed to motorized vehicles.
10. Identifying the methods of public access allowed/restricted on Forest Service roads, trails and routes.

The Planning, Environmental Analysis and Decision Process

National forest planning takes place at several levels: national, regional, forest, and project levels. The Revised Forest Plan FEIS is a forest-level analysis and its scope is confined to addressing the situation statements and possible environmental consequences of the plan. It does not attempt to address decisions made at higher levels, such as by the Chief of the Forest Service. It does, however, implement direction provided at those higher levels.

"Tiering" is the process under NEPA of relying on programmatic or "higher level" environmental analyses for the treatment of general matters and focusing on

more specific matters in the subsequent analysis. Environmental analyses for projects will in turn, tier to this, Revised Chugach Land and Resource Management Plan FEIS.

Copies of this FEIS and Revised Forest Plan may be obtained from the Forest Supervisor's Office in Anchorage, Alaska, the Forest's internet web site (www.fs.fed.us/r10/chugach/revision/index.htm) or on CD-ROM.

Additional documentation available to the public, including more detailed analyses of area resources, may be found in the planning record located at the Forest Supervisor's Office, 3301 C Street, Suite 300, Anchorage, Alaska, 99503-3998. Documents such as the 1984 Chugach National Forest Plan, the Analysis of the Management Situation, the Revised Forest Plan, and FEIS are available at public libraries throughout Southcentral Alaska, as well as at the Forest Supervisor's Office in Anchorage, Alaska.

Consultation Process

The National Forest Management Act (NFMA) requires that the public be offered opportunities to participate in the development, review, and revision of land management plans. Similarly, the National Environmental Policy Act (NEPA) requires identification and disclosure of the environmental effects of agency proposals and provides for public review and comment.

The Chugach used an open participatory approach to forest plan revision that is called collaborative learning. All interdisciplinary team meetings and revision related forest leadership team meetings were open to the public. At key points during the planning process additional consultation meetings were conducted with representatives of other state and federal agencies and Native Alaskan tribes. Typically these meetings were conducted just prior to the public release of draft and final planning documents to the general public. Agencies and tribes were given an opportunity to review our current planning direction and offer suggestions of changes that would make it more compatible with the management strategies on their lands. The Planning Team also worked closely with major landowners, primarily native corporations, with interests in the vicinity of the Chugach National Forest.

The purpose of the consultation meetings was to encourage dialogue between agencies, tribes and major landowners to promote coordination of various land management strategies and to integrate scientific and agency knowledge about problem situations in a systematic fashion.

Some agencies and landowners assigned one or more of their staff to attend all planning team meetings and work sessions as necessary to coordinate their land management strategies with the direction in the Revised Forest Plan. The Alaska Department of Natural Resources, Alaska Department of Fish and Game and the U.S. Fish and Wildlife Service assigned representatives to attend almost all planning team meetings. Other agencies and tribes were involved at key points during the planning process when necessary to coordinate their interests with current Forest Plan revision proposals.

Written summaries of land management strategies were provided to the Forest Service by:

1. Chugach Alaska Corporation
2. Chenega Corporation
3. Eyak Corporation
4. Tatitlek Corporation
5. State of Alaska

Recognizing that only the Forest Service has the authority to make the final decision, agencies, tribes and landowners were encouraged to be involved in all phases of the planning and decision making process to seek consensus. Although consensus was not achieves with all cases our consultation efforts resulted in increased rapport, respect and trust among agencies, tribes and landowners.

Newsletters, a Revision Website, telephone recordings and collaborative workshops were also used to keep the public informed on the Chugach National Forest Plan revision process.

Chapter 2–The Alternatives

Chapter 2 – The Alternatives

Introduction

This chapter describes a range of management alternatives considered for the Chugach National Forest, including a No Action, Preferred and six other alternatives considered in detail. These alternatives were developed to provide a range of forest management options for the next 10 - 15 years in response to public comments and resource concerns. Each of the alternatives is a potential the Revised Forest Plan that, if selected, could be implemented.

Chapter 2 is divided into the following five parts:

- discussion of how alternatives were developed;
- discussion of alternatives considered in detail and alternatives considered but eliminated from detailed study;
- discussion of the role of science;
- descriptions of the alternatives considered in detail; and,
- comparison of the alternatives considered in detail.

A large-scale map for each of the alternatives considered in detail is included in the map packet accompanying this document. The alternative maps show the locations of management prescriptions for each alternative.

Development of the Alternatives

The revision of the Forest Plan is based on an evaluation of the adequacy of the existing plan in light of changes in environmental, socio-economic and legal conditions. The core of this process was the formulation of forest management alternatives, which provided different perspectives on how this change would occur.

To develop alternatives, a collaborative learning process was implemented to emphasize early incorporation of public comments and continued public involvement. A key component of the collaborative learning process was opening Interdisciplinary Team (ID Team) meetings to the public. The Forest Supervisor also opened his staff meetings to the public. Throughout the planning process over 125 planning meetings were open to the public.

As required by NEPA, alternatives were developed using an interdisciplinary process. Because of extensive public involvement, it is important to understand each participant's role in the revision process (Table 2-1).

Table 2-1: Revision participant roles.

Roles	ID Team[1]	Science Advisors	General Public	Government Agencies	Native Governments	Forest Supervisor	Regional Forester
Lead Revision Process	X	X				X	
Write Revision Documents	X						
Critique and Evaluate Documents	X	X	X	X	X	X	
Develop Alternatives	X	X	X	X	X	X	
Consult with Governments				X	X	X	X
Make Critical Decisions						X	X

[1] Interdisciplinary Team

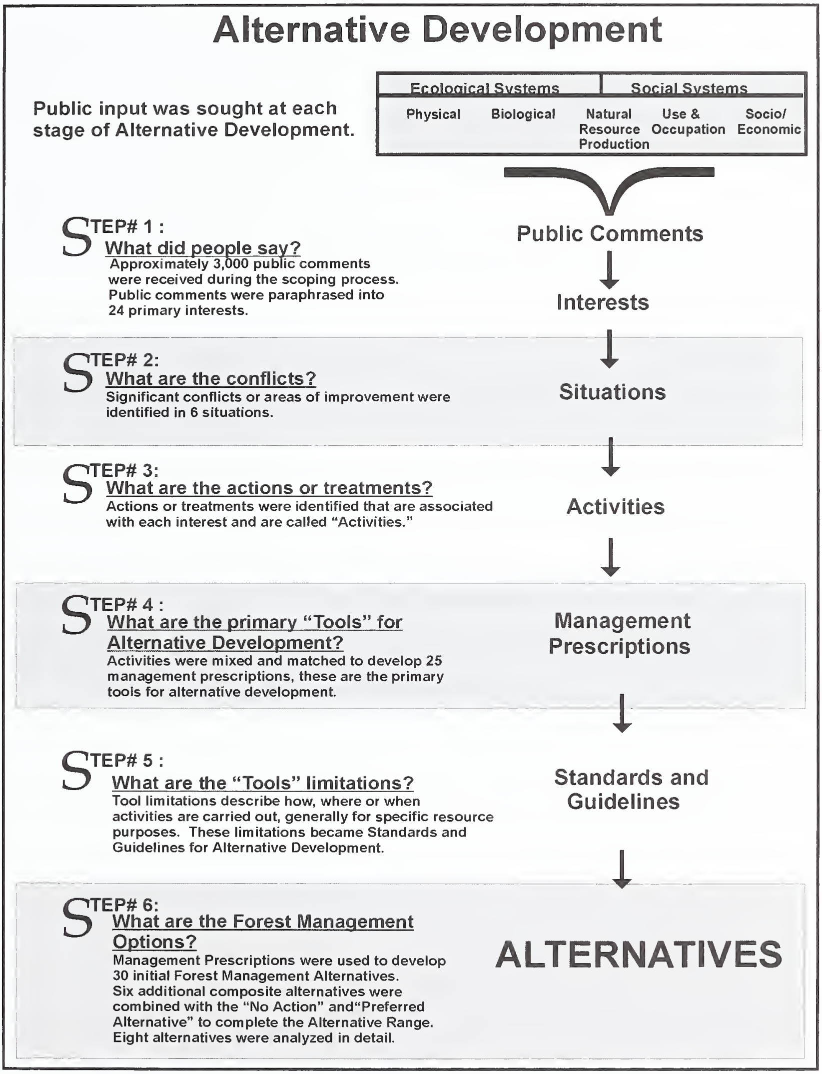
The alternative development process involved six primary steps (Figure 2-1). Participants were given an opportunity to provide input at each step.

To encourage participation by a local and national audience and to implement the six stages of alternative development, three primary communication techniques were used:

- periodic newsletters sent to those who expressed an interest;
- open Interdisciplinary Team meetings, collaborative learning workshops, and community meetings held in various communities in Southcentral Alaska; and,
- a web site, developed to disseminate information and provide further opportunities for participation.

Using these communication techniques, local communities and people from across the country participated throughout the alternative development process.

Figure 2-1: Alternative development.



The following are brief descriptions of each of the alternative development steps.

1) Interests

The first step in the collaborative learning process was determining the public's interests (desires) for the management of the Chugach National Forest. Following the publication of the Notice of Intent to revise the Forest Plan in the *Federal Register*, a newsletter was distributed and workshops were held in various communities to seek input.

Approximately 3,000 comments were received during the public comment period. Over the course of two months each comment was reviewed and categorized using a content analysis process. The result was the identification of 24 primary interests in the Chugach National Forest. Descriptions of each interest can be found in the planning record. These interests include:

- Air Quality
- Soil Productivity
- Water Quality
- Ecological Systems Management
- Habitat for Sustainable Populations of Brown Bears
- Management of Fish and Wildlife Habitat
- Threatened, Endangered and Sensitive Species
- Natural Resource Products - Forest Products
- Natural Resource Products - Minerals
- Communication Sites and Utility Corridor
- Heritage Resources
- Motorized Access
- Nonmotorized Access
- Natural Quiet
- Recreation Opportunities
- Scenic Quality
- Tourism
- Wild and Scenic Rivers
- Wilderness Designations
- Employment and Income
- Fire Protection
- Private Property Rights
- Quality of Life and Life Styles
- Subsistence

2) Situation Statements (Significant Issues)

Situation statements or situations identify where interests are in conflict or where existing conditions could be improved by changing the 1984 Forest Plan. The following situations will be the basis for alternative development:

- Ecological Systems Management;
- Habitat for Fish and Wildlife;
- Resource Development;
- Recreation/Tourism;
- Recommendations for Administrative and Congressional Designations; and,
- Subsistence.

These situation statements are described in detail in Chapter 1. The Forest Supervisor determined the six situation statements were appropriate for the comments received. Once interests and situations were identified, another newsletter was sent and a series of collaborative learning workshops were held to validate the findings.

For many of the interests there was little disagreement in a solution. These solutions became the basis for goals and objectives and standards and guidelines.

3) Activities

To address the interests, the ID Team identified activities (actions) associated with each interest. Examples of the activities include: soil/watershed projects, off highway vehicle use, personal use timber harvest. The list of activities is included in Appendix J, Management Prescription Activity Matrixes. Definitions of each of the activities are included in the Glossary.

4) Management Area Prescriptions

The next task was to identify how various activities could be mixed and matched into different management area prescriptions to address the situation statements. Management area prescriptions are various ways of managing an area of land, similar to city or borough zoning. Just as areas in a community are zoned as commercial (allowing business uses), industrial (allowing factories), or residential (allowing only homes, schools, etc.), the Forest is also "zoned" to allow or not allow various uses and activities. Land management zoning or “allocation” is done through the application of management area prescriptions (see Appendix J).

Management area prescriptions are designed to respond to different situations and in some cases interests. For example, if the situation statement is the desire for a primitive setting, the Backcountry prescription will implement a group of activities that will result in wild, undeveloped settings on a portion of the Forest.

Categories – The management area prescriptions are grouped into five categories to represent similar ecological processes, levels of development, or human influence. They range from little human influence (Category 1) to long-term human influence (Category 5):

> **Category 1** - Ecological processes such as fire, insects, and disease are allowed to operate relatively free from the direct influence of humans. Diversity resulting from natural succession and natural disturbances predominates and non-native vegetation is rare. Users must be self-reliant and should expect low levels of contact with other people. Few, if any, facilities are present. Travel is generally nonmotorized. Examples of prescriptions in this category are Primitive and Recommended Wilderness.
>
> **Category 2** - Direct human influence on the ecological processes is limited as much as possible but is sometimes evident. These areas may conserve representative or particularly rare and narrowly distributed ecological settings or components that may play a key role in the overall sustainability of larger landscapes. Habitat manipulation for conservation of species may take place. The type of human use varies but is generally not intensive. Travel may be nonmotorized or motorized. Heritage resources will appear in an

undisturbed state. Cabins and other historic, aboveground features will be present in their natural state, with minimal on-site interpretation. Data recordation is a preferred mitigation method. Examples of prescriptions in this category are Backcountry and Fish and Wildlife Conservation Area.

Category 3 - Consideration is given for both ecological processes and human occupancy. Resource management activities may occur but natural ecological processes and patterns will normally predominate, resulting in a landscape with an overall natural appearance and some evidence of human activity. Natural patterns or ecological processes are maintained or restored as a result of management activities. Forest users may expect to experience some isolation from the sights and sounds of humans in a setting that offers some challenge and risk. Motorized travel is allowed but may be restricted seasonally or to specific locations. Examples of prescriptions in this category are Fish, Wildlife and Recreation, and 501(b) - 3.

Category 4 - These areas are managed to meet a variety of ecological and human needs. Ecological processes are maintained while emphasizing selected biological structures and compositions that represent the range of natural variability. These lands are often intensively used, have a high density of facilities and roads, and may display significant evidence of vegetative manipulation. Users expect to see other humans and evidence of human activities. Examples of prescriptions in this category are Resource Development and Developed Recreation Complexes.

Category 5 - Human influences on the ecological processes are dominant and are usually evident. Changes in ecological processes are often long term. These lands are intensively used, have a high density of facilities and roads, and display significant evidence of vegetative manipulation. Users expect to see other humans and evidence of human activities. An example of a prescription in this category is Minerals.

Management Area Prescription Summary

The management area prescriptions are explained in detail in Chapter 4 of the Revised Forest Plan. Each prescription has a theme, management intent, allowed activities and a set of standards and guidelines. Each management area prescription has been assigned a unique number (the first digit represents the Prescription Category).

1. See the Management Prescription Activity Matrix in Appendix J for allowable activities by prescription.

2. Four management area prescriptions were based on Section 501(b) of the ANILCA. They are: 133 – 501(b) - Recommended Wilderness; 135 – 501(b) - 1; 213 – 501(b) – 2; and, 321 – 501(b) – 3.
3. Although the number of acres recommended for Wilderness designation in the Nellie Juan-College Fiord Wilderness Study Area vary by alternative, the Forest Service will continue to manage the entire study area for it's wilderness values. The Wilderness Study Area prescription will apply to all areas within the Nellie Juan–College Fiord Wilderness Study Area until Congress considers the Wilderness Study.
4. Three prescriptions have "winter motorized" and "summer and winter motorized" options; they are: 211 – Backcountry; 212 – Backcountry Motorized; and 213 – 501(b) – 2. When options are applied the three prescriptions are very similar; the primary difference is the Backcountry Motorized (212) Prescription allows for special use permit destination lodges while the other two prescriptions do not.
5. Two prescriptions, 135 – 501(b) – 1 and 210 – Backcountry* were developed for the FEIS Preferred Alternative.

The following is a brief summary of each management area prescription.

Category 1

111 Primitive Management Area - Primitive Areas are managed to emphasize primitive recreational opportunities in natural, unmodified landscapes.

121 Wilderness Study Management Area - The Nellie Juan-College Fiord Wilderness Study Area (WSA) is managed to maintain and protect the existing (1984) wilderness character. The WSA shall be managed as described in this prescription until Congress acts on this area. **The Wilderness Study Area Management Area does not vary by alternative.**

131 Recommended Wilderness Management Area - Recommended Wilderness is managed to maintain and protect the existing wilderness character. Recommended Wilderness shall be managed as described until Congress acts.

132 Wild River Management Area - Wild Rivers and designated segments of rivers, with their immediate environments, are managed to maintain, enhance and protect the free-flowing character and outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, or cultural values for the benefit and enjoyment of present and future generations. All hydroelectric power facilities and major water supply dams or diversions are prohibited. Wild Rivers recommended for designation in the Revised Forest Plan will be managed to maintain their outstandingly remarkable values and classification eligibility until Congress acts.

133 501(b) – Recommended Wilderness Management Area – Areas are managed concurrently to conserve fish and wildlife and their habitats and maintain wilderness character. Areas with this prescription will be recommended to Congress for Wilderness designation. The 501(b) – Recommended Wilderness Management Area will be managed as described in the prescription until Congress acts. Unresolvable conflicts between conserving fish and wildlife and their habitat and maintaining the area's potential for Wilderness designation, will be resolved by conserving fish and wildlife and their habitat as required by Section 501(b) of ANILCA.

135 501(b) - 1 – This area is managed to conserve fish and wildlife habitat in a wilderness-like setting.

141 Research Natural Area Management Area - Research Natural Areas (RNAs) form a long-term network of ecological reserves designated for non-manipulative research, monitoring, and education, and the maintenance of natural diversity, allowing natural physical and biological processes to prevail without human intervention.

142 Natural Processes Management Area - Areas are managed to let ecological processes dominate, with no human disturbance due to management activities or use. While recreation is one of several compatible human activities, this area is not a recreation-based prescription. Natural process areas recognize a range of primarily non-consumptive ecosystem values, especially intrinsic and life support values.

Category 2

210 Backcountry* - Backcountry Areas are managed to emphasize a variety of backcountry activities, including nonmotorized and motorized activities in natural appearing landscapes.

211 Backcountry Management Area - Backcountry Areas are managed to emphasize a variety of recreational backcountry activities in natural appearing landscapes. To address nonmotorized and motorized interests, three options apply to Backcountry Management Areas:

- Backcountry nonmotorized emphasis;
- Backcountry winter motorized allowed; and,
- Backcountry summer and winter motorized allowed.

212 Backcountry Motorized Management Area - Backcountry Motorized Areas are managed to emphasize a variety of recreational backcountry motorized activities in natural appearing landscapes. To address motorized and nonmotorized interests, two options apply to the Backcountry Motorized Management Areas:

- Backcountry motorized winter only; and,
- Backcountry motorized summer and winter.

213 501(b) - 2 Management Area - These lands are managed to emphasize the conservation of fish and wildlife and their habitats and provide for a variety of recreational opportunities for undeveloped activities in relatively unmodified landscapes. To address nonmotorized and motorized interests, three options apply to the 501(b) 2 Management Areas:

- 501(b) – 2 nonmotorized emphasis;
- 501(b) – 2 winter motorized allowed; and,
- 501(b) – 2 summer and winter motorized allowed.

221 EVOS Acquired Lands Management Area - As part of the *Exxon Valdez* Oil Spill Settlement, lands or interests in lands have been purchased with the goal of maintaining the land in perpetuity for conservation purposes and for the restoration of injured resources. **Management direction for these lands is established in the deeds or purchase agreements. Therefore this prescription does not vary by alternative.**

231 Scenic River Management Area - Scenic Rivers and designated segments of rivers, with their immediate environments, are managed to maintain, enhance, and protect the free-flowing character and outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, or cultural values for the benefit and enjoyment of present and future generations. All hydroelectric power facilities and major water supply dams or diversions are prohibited. Scenic River segments recommended for designation in the Revised Forest Plan will be managed to maintain their outstandingly remarkable values and classification eligibility until Congress acts.

241 Municipal Watershed Management Area - Municipal Watersheds are managed to protect the municipal water supply of communities in and adjacent to the Forest.

242 Brown Bear Core Area Management Area - Brown Bear Core Area Management Areas are managed to maintain landscapes and their associated ecological processes to provide habitat for brown bears and other wildlife species.

244 Fish and Wildlife Conservation Area Management Area - Fish and Wildlife Conservation Area Management Areas emphasize the conservation of fish and wildlife and their habitat.

Category 3

312 Fish, Wildlife and Recreation Management Area - Fish, Wildlife and Recreation Management Areas are managed to provide habitats for fish and wildlife species as well as year-round recreational opportunities with a variety of developed and dispersed settings.

313 Backcountry Groups Management Area - These areas are managed to emphasize recreational settings and opportunities with an undeveloped character but allow for larger groups and facilities to support them. This site-specific prescription is not intended to exceed 50 acres.

314 Forest Restoration Management Area - These areas are managed for a variety of uses with an emphasis on managing and/or restoring forest plant communities. The goal is to create and maintain sustainable forest conditions which prevent and/or reduce the susceptibility of forest vegetation to extensive damage from insects, disease, severe windstorm or wildfire, thus, preventing or mitigating the undesirable impacts that these disturbance processes can have on forest resource uses and values.

321 501(b) - 3 Management Area – These areas are managed to emphasize the conservation of fish and wildlife and their habitats while providing for a variety of multiple use activities.

331 Recreational River Management Area - Recreational Rivers or segments of rivers with their immediate environments are managed to maintain, enhance, and protect the free-flowing character and outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, or cultural values for the benefit and enjoyment of present and future generations. All hydroelectric power facilities and major water supply dams or diversions are prohibited. Recreational River segments recommended for designation in the Revised Forest Plan will be managed to maintain their outstandingly remarkable values and classification eligibility until Congress acts.

341 Developed Recreation / Reduced Noise Management Area - Developed Recreation / Reduced Noise Management Areas are managed to provide a range of year-round developed recreation opportunities in which human-generated noises are minimized in natural or naturally appearing landscapes. This management prescription shall apply to the site(s) identified. Other resource management activities, recreation opportunities, motorized or uses, etc. shall be guided by the management area prescription for the larger watershed.

Category 4

411 Resource Development Management Area - Resource Development Management Areas are managed for the economical and efficient production of wood fiber and special forest products and/or the prospecting, exploration, and development of minerals while developing a commodity transportation system that provides access for motorized recreation and tourism development.

441 Developed Recreation Complexes Management Area - Developed Recreation Complexes Management Areas are managed to provide developed recreation opportunities in which there are facilities for user comfort and convenience with the ability to accommodate large number of people in a naturally appearing setting.

Category 5

521 Minerals Management Area (site specific) - Minerals Management Areas are managed for the exploration, development, mining, and processing of locatable (base and precious metals, such as gold, silver, and copper, etc.), leasable (oil, gas, coal, etc.), and salable (sand, gravel, and quarry stone, etc.) minerals. This management prescription is applied to areas with currently approved plans of operations. The prescription is also used as criteria in the planning and design of proposed mineral activities and plans of operation. During the period before approval of the plan of operations, the initial Management Prescription(s) continue to apply to the project area.

522 Major Transportation / Utility Systems Management Area (site specific) - These management areas are managed for existing and future transportation and utility systems and electronic sites. These areas include corridors for state and federal highways, major oil and gas pipelines, electric power dams, reservoirs, transmission lines, including those identified by the State of Alaska and the Alaska Energy Authority, and major communication systems including telephone and microwave. This management area does not apply to Forest development roads or to roads that access private in-holdings.

5) Standards and Guidelines (Mitigation Measures)

Standards and guidelines are limitations on how, where or when activities are carried out, usually for specific resource protection purposes. The standards and guidelines represent mitigation measures for resource protection.

Two sets of standards and guidelines were developed: 1) a set of Forestwide standards and guidelines (Revised Forest Plan, Chapter 3), which apply to all alternatives; and, 2) a set of management area standards and guidelines (Revised Forest Plan, Chapter 4), which vary by management area prescription. The acreage and location of land areas assigned to management areas varies by alternative, but the prescription for each management area is the same for all alternatives.

Once the prescriptions and standards and guidelines were drafted, another newsletter was sent and a round of collaborative workshops was held to validate both products. Based on public comment and ID Team review, the standards and guidelines were modified for the Revised Forest Plan.

6) Alternatives

To facilitate the development of alternatives, an Alternative Development "Toolbox" was constructed. The toolbox included documents such as: planning direction, interests, situation statements (situations), standards and guidelines, management area prescriptions, activities, resource information and templates for alternative development. This toolbox was distributed to everyone who wanted to participate in alternative development. The idea was to provide an array of resource information and focus alternative development on addressing the situations.

Alternatives were developed in ID Team meetings, collaborative learning workshops, and community gatherings throughout various Southcentral Alaska communities. After six months of work, 30 comprehensive alternatives were developed. A detailed description of each alternative is available in planning record.

Table 2-2 displays the alternatives and the primary authors while the relative differences between each alternative are found in Table 2-3.

Table 2-2: Primary authors by alternative.

Alternative	Primary Authors	Alternative	Primary Authors
No Action	Interdisciplinary Team	16	Audubon Society
2	Interdisciplinary Team	17	Chugach Alaska Corp; Alaska Forest Association; Anchorage Snowmobile Club; Alaska Miners
3	Interdisciplinary Team	18	Seward Ranger District Employees
4	Interdisciplinary Team	19	National Wildlife Federation; Wilderness Society
5	Interdisciplinary Team	20	Turnagain Arm Conservation League
6	Interdisciplinary Team	21	Chugach Working Group; Alaska Center for the Environment
7	Copper River Watershed Project	25	Chugach Powder Guides
8	Focus Group – Cordova Residents	26	Cordova District Fisherman United
9	Focus Group – Cordova Residents	27	Focus Group – Girdwood Residents
10	Alaska Quiet Rights Coalition	28	Friends of Hope, Sunrise and Cooper Landing
11	Focus Group – Girdwood Residents	29	Focus Group – Hope Residents
12	Interdisciplinary Team	30	Focus Group – Hope Residents
13	Interdisciplinary Team	31	Prince William Sound Chapter of Audubon Society
14	Cordova Resident	32	Alaska Wilderness, Recreation and Tourism Association
15	Interdisciplinary Team	33	Alaska Visitors Association

Alternatives Considered in Detail and Alternatives Considered but Eliminated from Detailed Study

The Forest Supervisor directed the Interdisciplinary Team to review all 30 alternatives and to recommend a manageable number that address the range of situations.

Cluster analysis, a statistical procedure for detecting natural groupings of data, was used to determine alternatives that addressed the situations in a similar fashion. Based on the analysis the alternatives clustered into six groups. Upon further review, Alternatives 6 and 13 were removed from their associated groups. The ID Team determined that these alternatives were unique, among all alternatives, in how they addressed the situations. Alternative 6 and 13 focused predominately on resource development and Wilderness designations, respectively.

Next, a geographic information system (GIS) analysis was completed to disclose similarities and differences among alternatives in the same group. At this time an opportunity was provided for the ID Team, all alternative authors, and other members of the public to work together, with similar alternatives, to find common ground and produce one composite alternative for each group. Resource information was also reviewed to insure that all alternatives could produce the resources desired (e.g., timber was present in areas identified for Resource Development). Six composite alternatives were developed from the six groups (Alternatives A through F). A detailed description of each alternative is available

in Appendix H. The descriptions show how each alternative addresses the situations and interests and provides a narrative on the rationale behind the placement of the prescriptions.

The six composite alternatives and the outlying alternatives (6 and 13) were presented to the Forest Supervisor. He eliminated 6 and 13 from detailed analysis. He felt these alternatives were too limited in focus on how they addressed different situations. Alternative 6 focused directly on resource development while Alternative 13 focused directly on Wilderness designations. He also felt the composite alternatives addressed resource development and Wilderness designations adequately without the addition of these two alternatives.

The Forest Supervisor also eliminated from detailed study all alternatives that were used to develop the composites. He felt the composite alternatives were an adequate representation of how each of the grouped alternatives addressed the situations. Table 2-3 reflects under which group each alternative fell and the relative differences among all groups.

Table 2-3: Relative differences among grouped alternatives.

	Alternative					
Situations	**Group A** 4, 17 & 12	**Group B** 3, 8 & 29	**Group C** 11, 33, 30, 14 & 18	**Group D** 2, 27, 5, 10, 16, 7 & 25	**Group E** 19, 20, 26, 28 & 32	**Group F** 9, 15, 21 & 31
Ecological Systems	Active Management	Active Management	Mix	Natural Processes	Natural Processes	Natural Processes
Fish and Wildlife	Active Management	Active Management	Mix	Natural Processes	Natural Processes	Natural Processes
Free Use/Personal Use Forest Products	Highest	High	Moderate	Low	Low	Lowest
Commercial Forest Products	Highest	Moderate	Low	Low	Low	Lowest
Mineral Opportunities	Highest	High	Moderate	Low	Low	Lowest
Motorized Recreation – Summer	High	Highest	Moderate	Lowest	Low	Low
Motorized Recreation – Winter	Highest	High	Moderate	Lowest	Moderate	Moderate
Nonmotorized Recreation Summer	Lowest	Low	Moderate	Highest	High	High
Nonmotorized Recreation Winter	Lowest	Low	Moderate	Highest	High	High
Developed Recreation Facilities	High	Highest	Moderate	Moderate	Low	Lowest
Recreation Settings	Dispersed	Dispersed	Dispersed	Dispersed	Dispersed	Dispersed
Recommended Wilderness	None	Low	Moderate	High	High	Highest
Recommended Wild and Scenic Rivers	None	Low	Moderate	High	High	Highest
Recommended Research Natural Areas	None	Low	Moderate	High	High	High
Subsistence	Lowest	Moderate	High	High	High	Highest

The Role of Science in Alternative Development and Environmental Consequences

The integration of science was a critical component in alternative development and effects analysis. The benefits of this integration result in (1) a fuller and richer set of options for decisions, (2) uncertainty and risk associated with proposed courses of action are clearly displayed, (3) increased clarity with which evidence and rationales are expressed, and (4) enhanced insights about choices that are made and thereby strengthen possibilities for adaptive management.

The role of scientists and researchers has not been to engage in taking policy positions, or to make public statements regarding approval or disapproval of policies. However, throughout all steps of this planning process, the consideration of and adherence to principles of science has been a deliberate objective of Regional and Forest decision makers, as well as ID Team members. Scientists and researchers—both of the Forest Service and of other federal and state agencies, universities, and nongovernmental organizations—have been involved at all steps. Among the responsibilities of scientists and researchers in the Revised Forest Plan have been to help in:

- gathering, synthesizing, testing, and validating information;
- identifying and quantifying risk without recommending what level of risk is appropriate;
- describing the level of confidence in technical information;
- assuring quality of information by following science protocols, including peer review;
- establishing evaluation and decision making criteria; and,
- checking for consistency between research data and decision making.

To date, several major science assessments have been conducted in order to augment existing data and knowledge, including recreation and tourism, social and economic conditions of neighboring forest communities, vegetation modeling for the Kenai Peninsula, and selected wildlife species of concern throughout the Forest. In addition, several roundtable discussion panels have been convened to bring subject matter experts together to discuss very specific issues or questions, including a forest conservation strategy, the total economic valuation of Forest market and nonmarket outputs, and brief risk assessments of potential impacts to minerals development and subsistence opportunities. In order to verify that the range of alternatives was adequate to address the six major situations identified during the scoping process, a detailed review of key findings of the science assessments was conducted prior to the approval of all alternatives.

A science consistency evaluation was completed on several sections of the DEIS including, recreation/tourism, social/economic, Kenai forest vegetation, wildlife species of concern, fish and wildlife habitat, ecological systems management and

minerals (USDA Forest Service 2001). Changes and additions were made in the FEIS to respond to these evaluations.

Alternatives Considered in Detail

Following the review of the science findings the Forest Supervisor decided to include the composite alternatives A through F for detailed study. Based on the analysis presented in this DEIS and ideas presented in the other alternatives, the Forest Supervisor decided to construct an additional alternative. Next, the ID Team completed an analysis of how each alternative responded to the science findings. The Forest Supervisor considered this analysis and finalized the following alternatives to be considered in detail: No Action (required by 40 CFR 1502.14(d)), Preferred and Alternatives A - F. After the analysis of public comments on the DEIS and Proposed Revised Forest Plan, the Forest Supervisor directed that several changes be made in the Preferred Alternative, in response to public comments. Next, the ID Team conducted an analysis of the updated Preferred Alternative and incorporated their findings into the FEIS. The Regional Forester will approve an alternative for implementation and explain the reasons for this choice in the Record of Decision that accompanies this document.

The Forest Service is reevaluating its Roadless Area Conservation rule (36 CFR 294) and is currently enjoined from implementing all aspects of the rule by the U.S. District Court, District of Idaho (U.S. District Court for the District of Idaho 2001). The Forest Service issued interim direction for Roadless Area Protection in July 2001. The No Action Alternative, the Preferred Alternative, and Alternatives A, B, C, and D propose new road construction and/or timber harvest in inventoried roadless areas (see Chapter 3, Roadless Areas). The Chugach National Forest will manage inventoried roadless lands consistent with the disposition of the final rule.

Alternative Descriptions

In the following section, each of the alternatives that were analyzed in detail is described. To understand all the components of the alternatives, the following sections should also be reviewed:

- Forestwide Direction (Chapter 3 of the Revised Forest Plan; these do not vary by alternative);
- Management area prescriptions (Chapter 4 of the Revised Forest Plan); and,
- Detailed Alternative Descriptions (FEIS, Appendix H). The detailed descriptions address how each alternative addresses the situations and interests and provides a narrative on the rationale behind the placement of the prescriptions.

The eight alternatives analyzed in detail are summarized by prescription category in Table 2-4 and Figure 2-2. The prescription categories are described on pages 2-5 and 2-6.

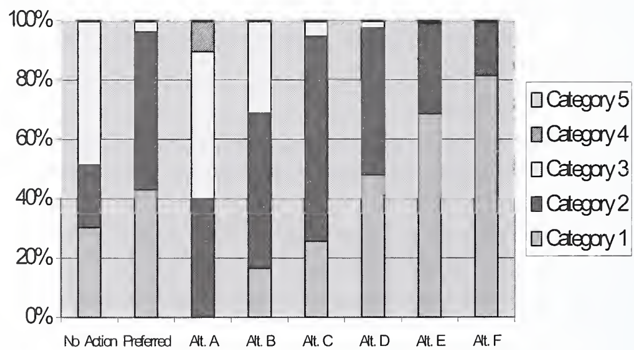
Table 2-4: Range of alternatives (in acres) by category.[1]

Alternative	Prescription Categories 1	2	3	4	5
No Action Alternative	1,662,150	1,162,040	2,654,630	0	12,760
Preferred Alternative	2,348,670	2,928,100	202,050	0	12,760
Alternative A	2,550	2,195,580	2,723,110	557,580	12,760
Alternative B	911,630	2,870,880	1,696,310	0	12,760
Alternative C	1,413,640	3,789,630	271,900	3,650	12,760
Alternative D	2,630,840	2,732,540	115,440	0	12,760
Alternative E	3,761,910	1,692,720	24,190	0	12,760
Alternative F	4,472,210	981,790	24,820	0	12,760

[1] Acres of Chugach National Forest administered land

- *Category 1* – Primitive, Wilderness Study Area, Recommended Wilderness, 501(b) - Recommended Wilderness, Wild River, Research Natural Area, 501(b) - 1
- *Category 2* – Backcountry, Backcountry Motorized, 501(b) - 2, EVOS Acquired Lands, Scenic River, Municipal Watershed, Brown Bear Core Area, Fish and Wildlife Conservation Area, Backcountry*
- *Category 3* – Fish, Wildlife and Recreation, Backcountry Groups, Forest Restoration, 501(b) - 3, Recreational River, Developed Recreation / Reduced Noise
- *Category 4* – Resource Development, Developed Recreation Complexes
- *Category 5* – Minerals, Major Transportation / Utility Systems

Figure 2-2: Graphic summary of the range of alternatives, given as percent of total Forest acreage by prescription category.



Three sets of information provide specific detail about each alternative.

1. Table 2-5 provides a relative overview of the alternatives based on their responses to the six situation statements.
2. Narratives of each alternative's responses to the situation statements are elaborated on the overview in Table 2-5.
3. Quantitative information describing each alternative is displayed in five tables at the end of the chapter, specifically:

   Table 2-10: Total number of acres in management prescriptions by alternative.

   Table 2-11: Projected outputs for key activities under full implementation level by alternative.

   Table 2-12: Fund code distribution by alternative for full implementation, based on BFES activities and costs.

Table 2-5: Relative similarities and differences between alternatives by situation.

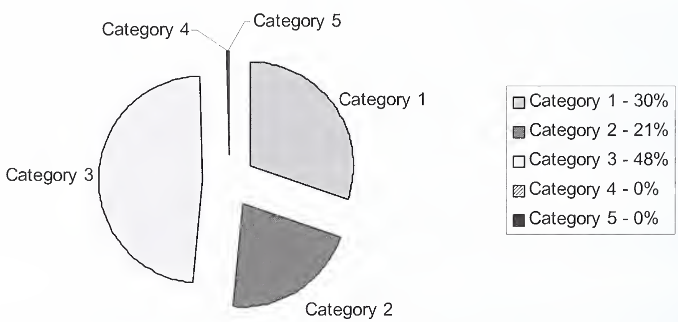
	Alternative							
Situation	**No Action**	**Preferred**	**A**	**B**	**C**	**D**	**E**	**F**
Ecological Systems	Mix	Natural Processes	Active Management	Active Management	Natural Processes	Natural Processes	Natural Processes	Natural Processes
Fish and Wildlife	Mix	Natural Processes	Active Management	Active Management	Natural Processes	Natural Processes	Natural Processes	Natural Processes
Free Use/Personal Use Forest Products	High	Moderate	Highest	High	Moderate	Low	Low	Lowest
Commercial Forest Products	Moderate	Low	Highest	Moderate	Low	Low	Low	Lowest
Mineral Opportunities	Moderate	Moderate	Highest	High	High	Low	Low	Lowest
Motorized Recreation – Summer	Moderate	Moderate	Moderate	Highest	Moderate	Lowest	Low	Low
Motorized Recreation– Winter	High	High	Highest	High	Moderate	Lowest	Moderate	Moderate
Nonmotorized Recreation – Summer	Moderate	High	Moderate	Lowest	Moderate	Highest	High	High
Nonmotorized Recreation – Winter	Low	Moderate	Lowest	Low	Moderate	Highest	High	High
Developed Recreation Facilities	Moderate	Moderate	High	Highest	Moderate	Moderate	Low	Lowest
Recreation Settings	Dispersed	Dispersed	Dispersed	Dispersed	Dispersed	Dispersed	Dispersed	Dispersed
Recommended Wilderness	Moderate	Moderate	None	Low	Moderate	High	High	Highest
Recommended Wild and Scenic Rivers	None	Moderate	None	Low	Moderate	High	High	Highest
Recommended Research Natural Areas	Highest	Moderate	Lowest	Moderate	Moderate	High	High	High
Subsistence	High	High	Lowest	Moderate	High	High	High	Highest

No Action

The No Action Alternative represents "no change to current management" and is, therefore, the 1984 Forest Plan expressed in the management area prescriptions to be used as a basis of comparison with other alternatives using the same terms and outputs. This "translation" allows the 1984 Forest Plan to be compared with other alternatives using the same terms and outputs. The primary theme of this alternative is a mix of recreational opportunities, Wilderness recommendations, wildlife and fish habitat, minerals, and forest products.

The No Action Alternative provides a mix of active and natural processes to sustain ecological systems and fish and wildlife habitat. It provides a mix of motorized/nonmotorized recreational activities, facilities, and recreational settings. The No Action Alternative provides a variety of natural resource products including forest products and minerals. It recommends Wilderness in portions of the Forest. Wild and Scenic Rivers were not addressed. A network of Research Natural Areas is recommended. Subsistence activities are emphasized.

Figure 2-3: No Action Alternative area allocations, by category.



**NOTE: Category 4 = 0.00% and Category 5 = 0.23%.

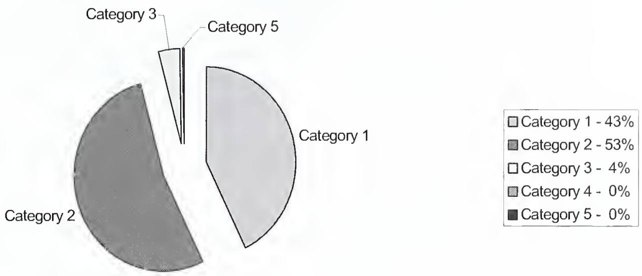
- *Category 1* – Wilderness Study Area; Recommended Wilderness; Research Natural Area
- *Category 2* – Backcountry; 501(b) - 2; EVOS Acquired Lands; Municipal Watershed; Fish and Wildlife Conservation Area
- *Category 3* – Fish, Wildlife and Recreation; 501(b) - 3
- *Category 5* – Minerals; Major Transportation / Utility Systems

Preferred Alternative

This alternative is the Regional Forester's Preferred Alternative. The primary theme of this alternative is conserving fish and wildlife habitat while providing recreational opportunities. Some changes have been made in the Preferred Alternative in the Final EIS, in response to public comment and ID Team review. (see Preface, Summary of Changes in the FEIS Preferred Alternative). However, these changes did not significantly affect outputs or the effects analysis.

The Preferred Alternative emphasizes natural processes across most of the Forest with active management in selected locations to sustain ecological systems and fish and wildlife habitat. It emphasizes winter motorized recreation, summer nonmotorized recreation, recreation facilities adjacent to existing roads and some marine waters, and undeveloped recreation settings across most of the Forest. The Preferred Alternative provides personal use/free use and small-scale commercial forest products to meet Forest stewardship objectives. It provides mineral opportunities in most areas with moderate to high mineral potential. It emphasizes Wilderness recommendations and provides a mix of Wild and Scenic River and Research Natural Area recommendations. Subsistence activities are emphasized.

Figure 2-4: Preferred Alternative area allocations, by category.



**NOTE: Category 4 = 0.00% and Category 5 = 0.23%.

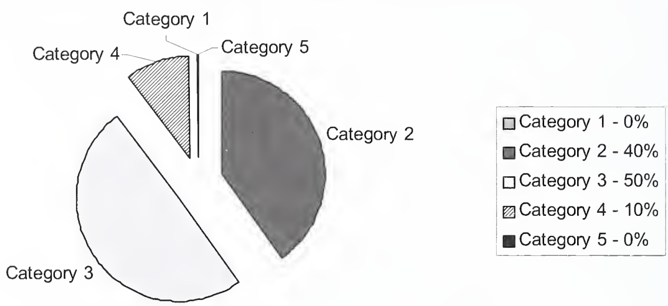
- *Category 1* – Primitive; Wilderness Study Area; Recommended Wilderness; 501(b) - Recommended Wilderness; Wild River; Research Natural Area; 501(b) - 1
- *Category 2* – Backcountry *; 501(b) - 2; EVOS Acquired Lands; Scenic River; Municipal Watershed; Brown Bear Core Area; Fish and Wildlife Conservation Area
- *Category 3* – Fish, Wildlife and Recreation; Backcountry Groups; Forest Restoration; 501(b) - 3; Recreational River; Developed Recreation / Reduced Noise
- *Category 5* – Minerals; Major Transportation / Utility Systems

Alternative A

The primary theme of this alternative is providing opportunities for active management (forest products, minerals, recreation etc.) while maintaining a predominately undeveloped setting across most of the Forest.

Alternative A emphasizes active management to sustain ecological systems and fish and wildlife habitat. It emphasizes motorized recreation (primarily winter), developed facilities, and a variety of recreational settings. Alternative A emphasizes personal use/free use and commercial forest products. It emphasizes mineral opportunities across the Forest. No Wilderness or Wild and Scenic Rivers are recommended. One Research Natural Area currently exists. Subsistence activities are emphasized.

Figure 2-5: Alternative A area allocations, by category.



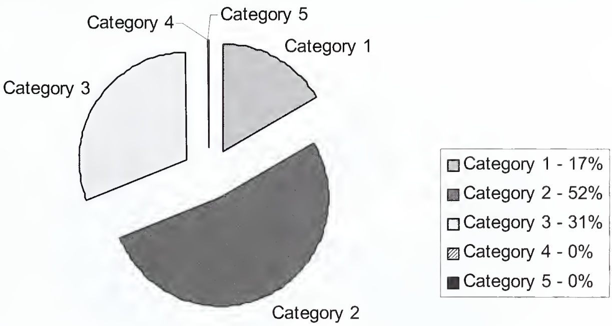
**NOTE: Category 1 = 0.05% and Category 5 = 0.23%.

- *Category 1* –Research Natural Area
- *Category 2* –Backcountry Motorized; EVOS Acquired Lands; Municipal Watershed; Brown Bear Core Area; Fish and Wildlife Conservation Area
- *Category 3* – Fish, Wildlife and Recreation; Forest Restoration; 501(b) - 3
- *Category 4* – Resource Development
- *Category 5* – Minerals; Major Transportation / Utility Systems

Alternative B
The primary theme of this alternative is conserving fish and wildlife habitat while providing opportunities for active management (forest products, minerals, recreation, etc.).

Alternative B emphasizes active management to sustain ecological systems and fish and wildlife habitat. It emphasizes motorized recreation (both summer and winter), developed facilities, and a variety of recreational settings. Alternative B emphasizes personal use/free use and commercial forest products to meet Forest stewardship objectives. It provides mineral opportunities across most of the Forest. Some Wilderness, Research Natural Areas, and Wild and Scenic Rivers are recommended. Subsistence activities are emphasized.

Figure 2-6: Alternative B area allocations, by category.



**NOTE: Category 4 = 0.00% and Category 5 = 0.23%.

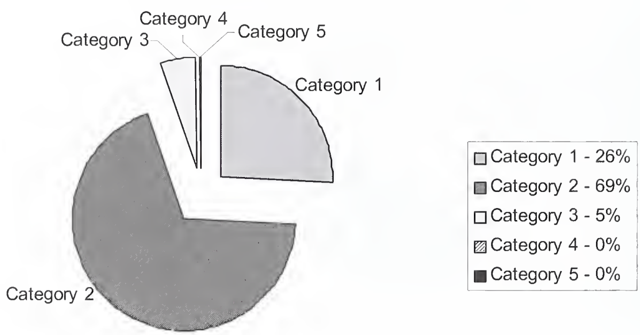
- *Category 1* – Primitive; Wilderness Study Area; Recommended Wilderness; Research Natural Area
- *Category 2* – Backcountry; Backcountry Motorized; 501(b) - 2; EVOS Acquired Lands; Municipal Watershed; Brown Bear Core Area; Fish and Wildlife Conservation Area
- *Category 3* – Fish, Wildlife and Recreation; Forest Restoration; 501(b) - 3; Recreational River
- *Category 5* – Minerals; Major Transportation / Utility Systems

Alternative C

The primary theme of this alternative is conservation of fish and wildlife and recreation.

Alternative C provides a mix of active management and natural processes to sustain ecological systems and fish and wildlife habitat. It emphasizes winter and summer motorized recreation, recreational facilities adjacent to existing roads and marine waters, and undeveloped recreation settings across most of the Forest. Alternative C provides personal use/free use and small-scale commercial forest products to meet Forest stewardship objectives. It provides mineral opportunities in most areas with moderate to high mineral potential. It provides some Wilderness, Wild and Scenic River, and Research Natural Area recommendations. Subsistence activities are emphasized.

Figure 2-7: Alternative C area allocations, by category.



**NOTE: Category 4 = 0.07% and Category 5 = 0.23%.

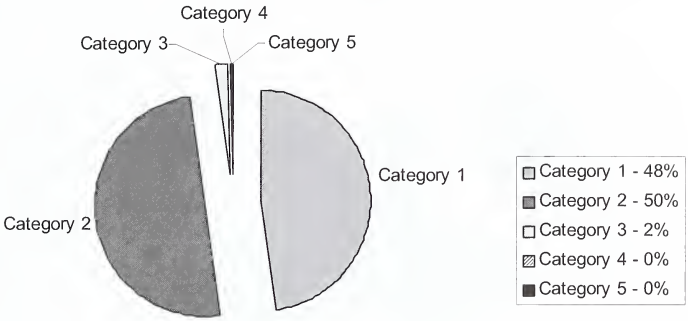
- *Category 1* – Primitive; Wilderness Study Area; Recommended Wilderness; 501(b) - Recommended Wilderness; Wild River; Research Natural Area
- *Category 2* – Backcountry; Backcountry Motorized; 501(b) - 2; EVOS Acquired Lands; Scenic River; Municipal Watershed; Brown Bear Core Area; Fish and Wildlife Conservation Area
- *Category 3* – Fish, Wildlife and Recreation; Backcountry Groups; Forest Restoration; 501(b) - 3; Recreational River
- *Category 4* – Resource Development; Developed Recreation Complexes
- *Category 5* – Minerals; Major Transportation / Utility Systems

Alternative D

The primary theme of this alternative is nonmotorized opportunities, natural quiet, natural processes, minimal recreational facilities, and undeveloped recreational settings.

Alternative D emphasizes natural processes to sustain ecological systems and fish and wildlife habitat. This alternative emphasizes nonmotorized activities and natural quiet more than any other alternative. It emphasizes minimal recreation facilities. It emphasizes undeveloped recreational settings. Alternative D provides personal use/free use forest products and small-scale forest products to meet Forest stewardship objectives. Large areas are recommended to be withdrawn from future mineral entry. It emphasizes Wilderness, Wild and Scenic River and Research Natural Area recommendations. Subsistence activities are emphasized.

Figure 2-8: Alternative D area allocations, by category.



**NOTE: Category 4 = 0.00% and Category 5 = 0.23%.

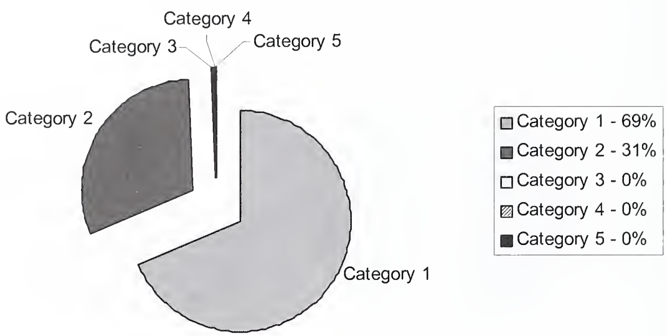
- *Category 1* – Primitive; Wilderness Study Area; Recommended Wilderness; 501(b) - Recommended Wilderness; Wild River; Research Natural Area
- *Category 2* – Backcountry; Backcountry Motorized; 501(b) - 2; EVOS Acquired Lands; Scenic River; Municipal Watershed; Brown Bear Core Area; Fish and Wildlife Conservation Area
- *Category 3* – Fish, Wildlife and Recreation; 501(b) - 3; Developed Recreation / Reduced Noise; Developed Recreation Complexes
- *Category 5* – Minerals; Major Transportation / Utility Systems

Alternative E

The primary theme of this alternative is natural processes, nonmotorized recreational activities, minimal recreational facilities, and undeveloped recreational settings.

Alternative E provides natural processes to sustain ecological systems and fish and wildlife habitat. It emphasizes nonmotorized recreational activities (except for traditional motorized activities allowed in ANILCA). It emphasizes minimal recreational facilities. It emphasizes undeveloped recreational settings. Alternative E emphasizes personal use/free use forest products and small-scale forest products to meet Forest stewardship objectives. Large areas are recommended to be withdrawn from future mineral entry. It emphasizes Wilderness, Wild and Scenic River, and Research Natural Area recommendations. Subsistence activities are emphasized.

Figure 2-9: Alternative E area allocations, by category.



**NOTE: Category 3 = 0.44%, Category 4 = 0.00% and Category 5 = 0.23%.

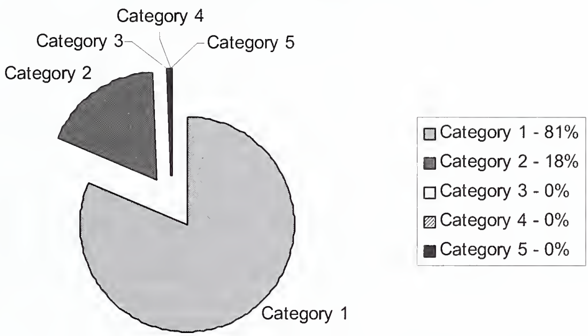
- *Category 1* – Primitive; Wilderness Study Area; Recommended Wilderness; 501(b) - Recommended Wilderness; Wild River; Research Natural Area
- *Category 2* – Backcountry; Backcountry Motorized; 501(b) - 2; EVOS Acquired Lands; Scenic River; Municipal Watershed; Fish and Wildlife Conservation Area
- *Category 3* – Fish, Wildlife and Recreation; 501(b) - 3; Recreational River; Developed Recreation / Reduced Noise
- *Category 5* – Minerals; Major Transportation / Utility Systems

Alternative F

The primary theme of this alternative is natural processes, nonmotorized recreational activities, minimal recreational facilities, and undeveloped recreational settings.

Alternative F emphasizes natural processes to sustain ecological systems and fish and wildlife habitat. It emphasizes nonmotorized recreational activities (except for traditional motorized activities allowed in ANILCA). It emphasizes minimal recreational facilities. It emphasizes undeveloped recreational settings. Alternative F provides personal use/free use forest products to meet Forest stewardship objectives. Large areas are recommended to be withdrawn from future mineral entry. It emphasizes Wilderness, Wild and Scenic River and Research Natural Area recommendations. Subsistence activities are emphasized.

Figure 2-10: Alternative F area allocations, by category.



**NOTE: Category 3 = 0.45%, Category 4 = 0.00% and Category 5 = 0.23%.

- *Category 1* – Wilderness Study Area; Recommended Wilderness; Wild River; Research Natural Area
- *Category 2* – Backcountry; Backcountry Motorized; EVOS Acquired Lands; Scenic River; Municipal Watershed; Brown Bear Core Area; Fish and Wildlife Conservation Area
- *Category 3* – Fish, Wildlife and Recreation; 501(b) - 3; Recreational River; Developed Recreation / Reduced Noise
- *Category 5* – Minerals; Major Transportation / Utility Systems

Comparison of the Alternatives Considered in Detail

This section is a summary of the environmental consequences presented in Chapter 3. It reviews the differences among alternatives as they relate to each of the six situations. Refer to Chapter 3 of the FEIS and the Appendixes for additional information and resources and environmental consequences. Appendix F displays how roads, trails and routes would be managed for public access for each alternative.

Ecological Systems Management

The Ecological Systems Management Situation has two primary components:

- the effect of each alternative on maintaining intact ecological systems and their associated elements of biological diversity; and,
- the social preference each alternative implements for either active management or natural processes to maintain ecological systems.

<u>Maintaining Ecological Systems and Biological Diversity</u>

All alternatives maintain intact ecological systems on the Chugach National Forest and their associated elements of biological diversity. The existing proportions of vegetation types would not change significantly under any alternative. The proportion of forest structural classes would not vary among alternatives on a Forestwide basis. At a more site-specific scale, the No Action Alternative and Alternative A would allow the greatest amount of active management activities, resulting in the maintenance of a larger proportion of early successional conditions on the Kenai Peninsula.

The habitat diversity of the Chugach would not be adversely affected under any alternative. The risk of major impacts to any bioenvironmental type is low in all alternatives. While risks are minimal on a Forestwide scale, the No Action Alternative and Alternative A with the greatest proportion of bioenvironmental classes in Category 3, 4, and 5 prescriptions, present greater risks within certain bioenvironmental classes than the remaining alternatives (Figure 2-11).

The amount of active reforestation of spruce bark beetle-impacted forest on the Kenai Peninsula varies by alternative. The No Action Alternative and Alternatives A and B allow the greatest opportunities for active reforestation of high mortality beetle-infested spruce stands on the Kenai Peninsula, with the Preferred Alternative and Alternative C allowing slightly less (Figure 2-12).

<u>Social Preference for Active Management or Natural Processes</u>

Prescription Categories can generally be used to reflect an alternative's emphasis for Active Management or Natural Processes (see Figure 2-2). Category 1 and 2 prescriptions emphasize natural processes, while Category 3 – 5 prescriptions provide for active management.

To maintain ecological systems, Alternatives A and B focus on active management. The No Action Alternative provides a fairly even split between active management and natural processes (52 percent and 48 percent,

respectively). The Preferred Alternative and Alternatives C – F focus on natural processes to maintain ecological systems.

Figure 2-11: Bioenvironmental classes of the Chugach National Forest with at least 12 percent of area in Category 1 or 2 prescriptions by alternative.

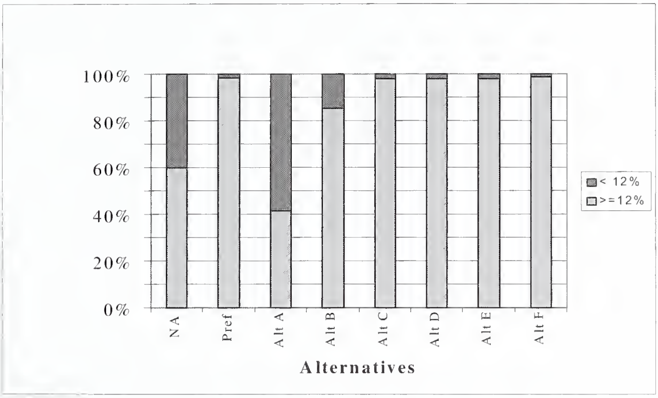
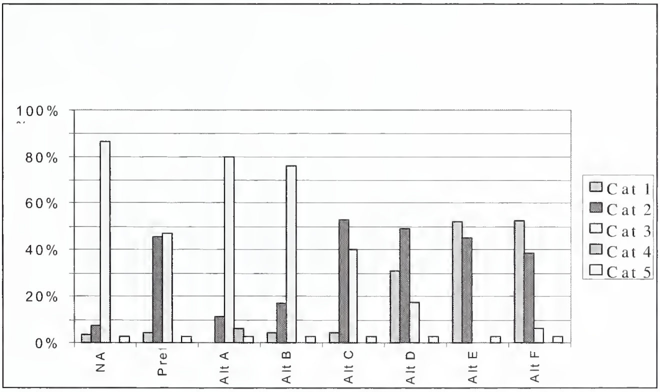


Figure 2-12: Percent of Kenai portion of Chugach National Forest heavily infested by spruce bark beetle (mapped as infested for 3+ years) by prescription category and alternative.



Habitat for Fish and Wildlife

The Habitat for the Fish and Wildlife Situation has three primary components:

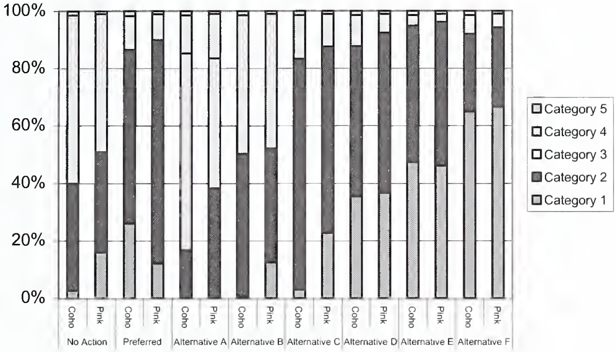
- the effect of each alternative on aquatic ecosystems and essential fish habitat;
- the effect of each alternative on wildlife habitat; and,
- the social preference each alternative implements for either active management or natural processes to maintain habitat for fish and wildlife.

Aquatic Ecosystems and Essential Fish Habitat

The primary criteria used to evaluate the eight alternatives and determine their impact on fisheries and aquatic habitat (relative risk ranking) include miles of proposed roads, acres of proposed harvest, areas of increased intense recreation, and amount of fisheries habitat restoration and improvement. Alternatives A, No Action, and B propose slightly higher levels of management activities, and have higher probability of creating adverse effects. Alternatives C, D, E, F, and the Preferred Alternative have most watersheds, and particularly those more productive watershed associations, placed in Category 1 or 2 prescriptions. The risks of adverse effects are greatly reduced with proper mitigation measures, including Best Management Practices and implementation of standards and guidelines to protect aquatic habitat under all of the alternatives. Figure 2-13 shows the percentage of coho and pink salmon habitat by prescription category.

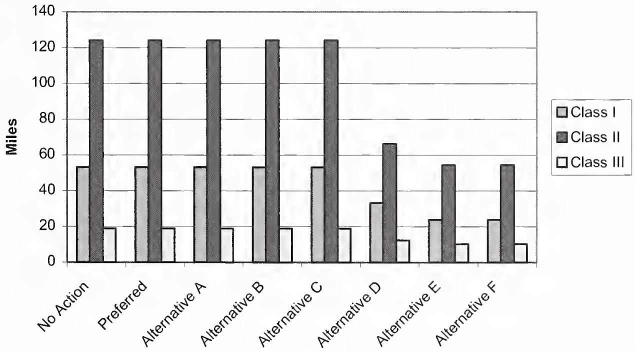
To determine the potential risk to spawning and rearing habitat, the percentage of the anadromous fish habitat that is within the five prescription categories was analyzed. Low prescription categories have lower levels of management actions. Higher prescription categories have higher levels of management actions. Alternatives that have large percentages of Category 1 and 2 prescriptions, with their low level of ground disturbing activities, have a low probability of altering the structure and function of fish habitat. Those alternatives also have less risk for potential negative effects on aquatic habitats.

Figure 2-13: Percentage of coho and pink salmon habitat by prescription category.



The spruce bark beetle and timber harvest has resulted in a loss of riparian vegetation on the Kenai Peninsula. This creates a potential long-term loss of streamside vegetation affecting bank stability, shade, nutrient input, and large woody debris. The amount of streamside restoration activities are limited by amount of Recommended Wilderness prescription applied. Figure 2-14 depicts the amount of restoration by alternative.

Figure 2-14: Potential stream class I, II and III restoration miles.



The amount of fisheries habitat improvement activities does not vary significantly among alternatives, except for Alternatives D, E and F, which have fewer activities.

Habitat for Wildlife
Forestwide standards and guidelines are sufficient to maintain sustainable populations of all wildlife species under all alternatives. All alternatives would provide sufficient habitat for viable populations, well distributed through a combination of land allocations and management area prescriptions. There are differences among alternatives for some species due to certain management activities.

Analysis shows that for all species habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest. However, some local populations are more ephemeral because of reduced population levels and increased susceptibility to environmental extremes and stochastic (random) events associated with reduced habitat abundance and distribution. Vacated habitats may become recolonized in the future.

Overall, all alternatives represent a low level of risk of not maintaining viable populations because (1) large landscapes will have minimum disturbance and will have intact systems and processes and (2) managed landscapes will be within the range of natural viability.

Social Preference for Active Management or Natural Processes
Prescription categories can generally be used to reflect an alternative's emphasis for Active Management or Natural Processes. (see Figure 2-2: Alternatives by Prescription Category.) Category 1 and 2 prescriptions emphasize natural processes while Category 3 – 5 prescriptions provide for active management.

To maintain fish and wildlife habitat, Alternatives A and B focus on active management. The No Action Alternative provides a fairly even split between active management and natural processes (52 percent and 48 percent respectively). The Preferred Alternative focuses on natural processes or active management that mimics natural processes to maintain fish and wildlife habitat. Alternatives C, D, E, and F focus on natural processes to maintain fish and wildlife habitat.

Resource Development
The Resource Development Situation has two primary components:

- the effect of each alternative on providing mineral opportunities; and,
- the effect of each alternative on providing forest products.

Minerals
Under the General Mining Law of 1872, national forest lands are available for mineral exploration and prospecting, and for mineral development and production, unless the lands are specifically withdrawn from all forms of mineral entry. Lands in the Copper River addition, while not subject to the General

Mining Law of 1872, are subject to the Mineral Leasing Act of March 4, 1917 (ANILCA, Sec. 502). The Forest Service can request the Bureau of Land Management to withdraw certain areas from all forms of mineral entry if necessary to meet the intent of the management area prescription. In addition, lands designated by Congress for Wilderness and Wild River status are also withdrawn from mineral entry in order to fulfill the purposes of those designations. (Such withdrawals are subject to any existing valid mineral rights.) When the Record of Decision is issued for the selected alternative, the Forest Service may request that the Bureau of Land Management withdraw certain management areas, such as Research Natural Areas, from any and all forms of mineral entry. Some management areas, such as Wilderness, would be withdrawn when designated by Congress. Table 2-6 displays the amount of area recommended for withdrawal by alternative.

Alternatives vary on the amount recommended for mineral withdrawal based on the emphasis of each alternative. The least amount of land that could be withdrawn is in Alternative A, where only 0.2 percent would either be recommended for withdrawal or withdrawn upon designation. The most land proposed for withdrawal would be in Alternative F at 80.9 percent.

Table 2-6: Lands/mineral estate recommended for withdrawal.

Mineral Potential	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Total Acreage Recommended for Withdrawal[1]	1,668,990	1,897,670	9,390	829,750	1,057,100	2,227,750	2,862,180	4,445,200
Percent Recommended Withdrawn	30.4%	34.6%	0.2%	16.3%	19.2%	40.6%	52.1%	80.9%

[1] Includes lands that may be recommended for withdrawal (Research Natural Area, Developed Recreation Complex, etc.) or would be withdrawn upon designation (Wilderness, Wild River, etc.)

Forest Products

The Forest Products component is displayed in two categories: Forest Products (Chargeable) from suitable timberlands and Forest Products (Nonchargeable) from unsuitable forest lands. Chargeable refers to commercial timber sales where an ASQ (Allowable Sale Quantity) has been calculated and the timberlands are managed for the continuous production of wood fiber for industrial wood use. Nonchargeable forest lands may include harvest of timber products, but an ASQ is not calculated and the harvest is made to meet Forest stewardship objectives such as fuel reduction, wildlife habitat improvement or insect and disease suppression or to provide free use/personal use forest products.

Allowable Sale Quantity (ASQ) refers to the upper level of scheduled commercial timber harvest to meet demands for forest products. The harvest would come from lands identified as suitable for timber production. Alternatives A, B and the No Action would have an allowable sale quantity (Table 2-7).

Table 2-7: Annual allowable sale quantity (chargeable).

Key Indicators	Unit of Measure	Time Period	Alternative							
			No Action	Preferred	A	B	C	D	E	F
Allowable Sale Quantity (ASQ)										
ASQ - Cubic	MMCF	Annual	1.6	0	3.5	1.3	0	0	0	0
ASQ – Board Feet	MMBF	Annual	7.5	0	16.3	6.1	0	0	0	0
ASQ – Harvest Acres	Acres	Annual	370	0	771	292	0	0	0	0

Nonchargeable timber harvest provides incidental forest products to meet objectives such as fuel reduction, wildlife habitat improvement, insect and disease suppression and free use/personal use forest products. All alternatives provide some level of nonchargeable harvest (Table 2-8). Actual harvest depends on the demand and level of Forest Service funding.

Table 2-8: Vegetation management (nonchargeable).

Key Indicators	Unit of Measure	Time Period	Alternative							
			No Action	Preferred	A	B	C	D	E	F
Nonchargeable - Cubic	MMCF	Annual	0.63	0.43	0.73	0.63	0.43	0.31	0.25	0.23
Nonchargeable – Board Feet	MMBF	Annual	2.21	1.51	2.71	2.51	1.71	1.00	0.80	0.70
Nonchargeable – Harvest Acres	Acres	Annual	601	375	759	712	426	355	260	235

Recreation and Tourism

The analysis of environmental effects for recreation and tourism compares the differences in the alternatives' response to three primary questions:

1. What are the differences among alternatives in recreation settings and with the existing, inventoried Recreation Opportunity Spectrum (ROS) classes?
2. How do the alternatives respond to anticipated increases in recreation use by providing new infrastructure and capacity?
3. How will the alternatives improve significant situations related to recreation and user conflicts or situations, primarily winter motorized and nonmotorized recreation opportunities on the Kenai Peninsula?

These three questions and the factors they address summarize the key indicators that affected development of each alternative. Each alternative emphasizes a different mix of recreation settings, infrastructure and capacity, and reduction of user conflicts consistent with the theme of the alternative. Across the range of alternatives, all the different interests of the Recreation/Tourism Situation are addressed.

Summary of Recreation Consequences by Alternative

This section provides a brief description of how each alternative addresses the Recreation/Tourism Situation in terms of responses to the three primary questions: recreation infrastructure, recreation settings, and decrease in user conflicts. Following the summaries is a graph displaying the distribution of ROS classes for each alternative, a table that displays existing and proposed developed recreation facilities for each alternative, and a graph that displays the dispersed recreation capacity for each alternative.

<u>No Action Alternative</u>

The No Action Alternative allows for opportunities to increase use and development in the Kenai Peninsula and Copper River Delta geographic areas. Prince William Sound emphasizes a wild character and limited development. Recreation settings are primarily Semi-primitive Motorized and Roaded Natural except in Prince William Sound where Semi-primitive Motorized and Primitive II dominate. Few areas are identified to separate motorized and nonmotorized winter or summer recreation activities beyond currently identified areas.

<u>Preferred Alternative</u>

The Preferred Alternative allows for opportunities to increase use and development concentrated along existing road corridors (3/4 mile on either side of roads). Prince William Sound and the Copper River Delta geographic areas emphasize dispersed recreation use and limited development. Recreation settings are primarily Primitive and Semi-primitive Nonmotorized and Motorized away from these corridors. Many areas across the Forest are proposed to be managed to separate motorized and nonmotorized winter and summer recreation activities to reduce user conflicts.

<u>Alternative A</u>

Alternative A allows for opportunities to increase use and development in all geographic areas of the Forest. Recreation settings are primarily Semi-primitive Motorized to Roaded Natural. All geographic areas emphasize motorized recreation activities winter and summer, so no areas are designated for nonmotorized settings.

<u>Alternative B</u>

Alternative B allows for opportunities to increase use and development in Kenai Peninsula and Copper River Delta geographic areas of the Forest. In Prince William Sound, dispersed recreation and limited development are emphasized, except adjacent to Whittier where higher use and development levels are allowed. Recreation settings are primarily Semi-primitive Motorized to Roaded Natural. A few selected areas on the Kenai Peninsula are proposed to be managed to separate motorized and nonmotorized winter and summer recreation activities.

<u>Alternative C</u>

Alternative C allows for opportunities to increase use and development concentrated along existing road corridors (1/2 mile on either side of roads). In Prince William Sound and the Copper River Delta geographic areas, dispersed

recreation use and limited development are emphasized. Recreation settings are primarily Semi-primitive Motorized and Nonmotorized, and Roaded Natural and Modified. Several selected areas on the Kenai Peninsula are proposed to be managed to separate motorized and nonmotorized winter and summer recreation activities.

<u>Alternative D</u>

Alternative D allows for opportunities to increase use and development concentrated along existing road corridors (1/4 mile on either side of roads). In Prince William Sound, the Copper River Delta, and areas outside the roaded corridors on the Kenai Peninsula geographic areas, dispersed recreation use and limited development are emphasized. Recreation settings are primarily Semi-primitive Motorized, Semi-primitive Nonmotorized, Roaded Natural and Roaded Modified. Several selected areas on the Kenai Peninsula are proposed to be managed to separate motorized and nonmotorized winter and summer recreation activities.

<u>Alternative E</u>

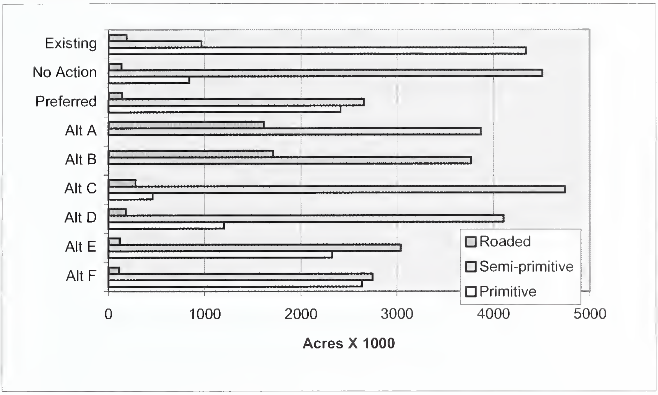
Alternative E allows for opportunities to increase use and development concentrated along existing road corridors (1/4 mile on either side of road). In Prince William Sound, the Copper River Delta, and areas outside the roaded corridors on the Kenai Peninsula geographic areas, dispersed recreation use and limited development are emphasized. Recreation settings are primarily Primitive to Semi-primitive Motorized. Much of the Kenai Peninsula geographic area emphasizes nonmotorized recreation activities winter and summer. Prince William Sound and Copper River Delta have selected areas separating motorized and nonmotorized winter and summer recreation activities.

<u>Alternative F</u>

Alternative F allows for opportunities to increase use and development concentrated along existing road corridors (1/4 mile on either side of road). In Prince William Sound, the Copper River Delta, and areas outside the roaded corridors on the Kenai Peninsula geographic areas, dispersed recreation use and limited development are emphasized. Recreation settings are primarily Primitive to Semi-primitive Nonmotorized. All geographic areas emphasize nonmotorized recreation activities winter and summer, so no areas are designated for motorized settings.

Each alternative's distribution of the major ROS classes is shown in Figure 2-15.

Figure 2-15: Forestwide distribution of ROS classes.



Developed recreation facilities and their capacities provided under each alternative are displayed in Table 2-9a. Developed capacity proposed under all of the alternatives will meet the projected demand.

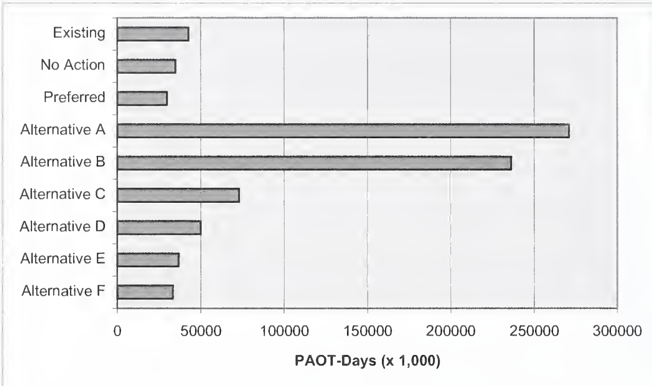
Table 2-9a: Developed recreation facilities by alternative – Forestwide.

	Existing	Alternative							
		No Action	Preferred	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
CAMPGROUNDS									
PAOT-days	581,122	638,582	621,682	638,582	638,582	638,582	628,442	618,302	618,302
No. of campgrounds	15	19	18	19	19	19	18	17	17
CABINS									
PAOT-days	93,580	131,980	128,380	145,180	145,180	146,380	137,980	128,380	104,380
No. of cabins	43	75	72	86	86	87	80	72	52
DAY USE SITES									
PAOT-days	639,265	652,365	668,490	678,165	657,740	652,365	639,265	639,265	639,265
No. of sites	31	34	38	41	36	34	31	31	31
TRAILHEADS									
PAOT-days	77,344	180,409	218,574	229,684	266,914	239,539	192,454	154,129	127,849
No. of trailheads	27	36	46	41	44	42	41	37	34
DEVELOPMENT NODES									
Backcountry Groups prescription	0	0	2	0	0	18	0	0	0
Semi-primitive Groups ROS	0	0	0	0	0	10	4	3	4

Source: USDA Forest Service INFRA Database.

The capacity for dispersed recreation opportunities (general forest areas not in developed sites) is related to the recreation setting and expectations that people have for particular settings. All of the alternatives assign the Roaded ROS class to the road corridors to allow for construction of developed recreation facilities and to provide for more intense management of recreation opportunities. In all alternatives, the available supply of dispersed recreation opportunities across the Chugach National Forest will greatly exceed the projected demand. In addition to the capacity in road corridors, Alternatives A and B have the highest dispersed capacity and Alternative F the lowest.

Figure 2-16: Forestwide dispersed recreation capacity.

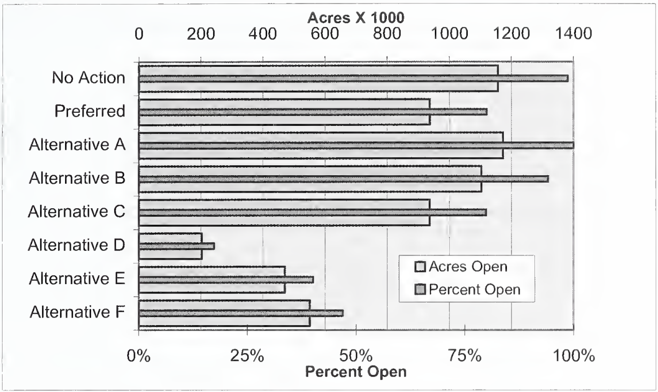


Recreation Conflicts and Situations

The major conflict or situation addressed in the alternatives is the allocation of winter season motorized and nonmotorized activities, and to a lesser degree, the summer season. This conflict is most intense on the Kenai Peninsula. Many of the alternatives were specifically designed to allow or restrict motorized and nonmotorized uses on the Kenai Peninsula.

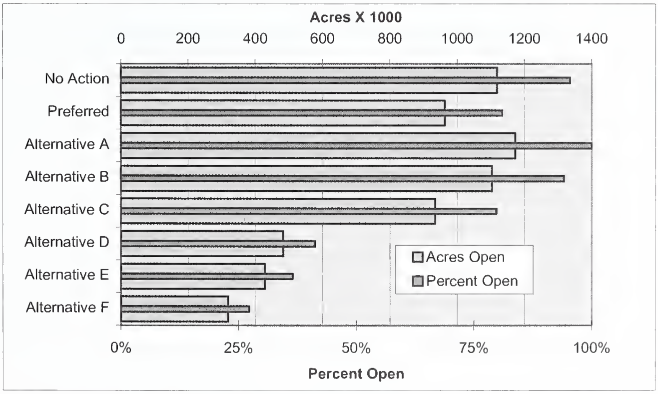
Winter snowmachine use is generally allowed in all alternatives. All of the alternatives, except Alternative A, identify specific areas of varying size that are closed to motorized uses. Acres available for winter snowmachine activities on the Kenai Peninsula, by alternative, are shown in Figure 2-17.

Figure 2-17: Acres available for winter snowmachine activity - - Kenai Peninsula.



Winter helicopter access for heli-skiing is similar to snowmachine use. There are some slight differences, especially in the Preferred and Alternatives D and F. Alternatives D and the Preferred Alternative allocate slightly more area for helicopter access while Alternative F allocates slightly less for helicopter access. Acres available for winter helicopter activities on the Kenai Peninsula, by alternative, are shown in Figure 2-18.

Figure 2-18: Acres available for winter helicopter activities - - Kenai Peninsula.

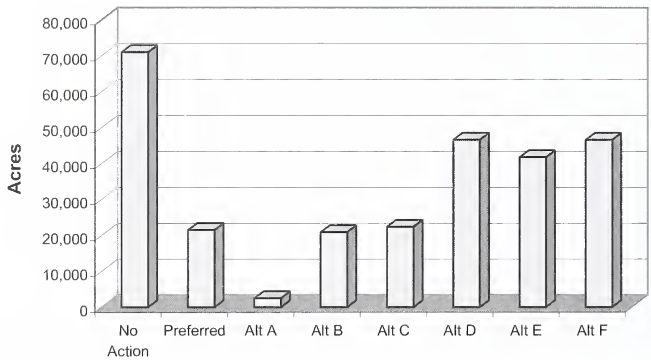


Recommendations for Administrative (Research Natural Areas) and Congressional (Wilderness and Wild and Scenic Rivers) Designation

This situation has three primary components, recommendations for: Research Natural Areas; Wilderness; and, Wild and Scenic Rivers.

Research Natural Areas
The Chugach National Forest currently has one designated Research Natural Area. The eight alternatives recommend differing number acres for Research Natural Areas (Figure 2-19).

Figure 2-19: Recommended and existing Research Natural Areas by alternative (acres).



	No Action	Preferred	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F
Number of RNAs	9	5	1	4	5	8	7	8

Wilderness
The Chugach National Forest currently has no designated Wilderness. The 1984 Forest Plan recommended approximately 1.7 million acres of the ANILCA designated Nellie Juan-College Fiord Wilderness Study Area for Wilderness designation.

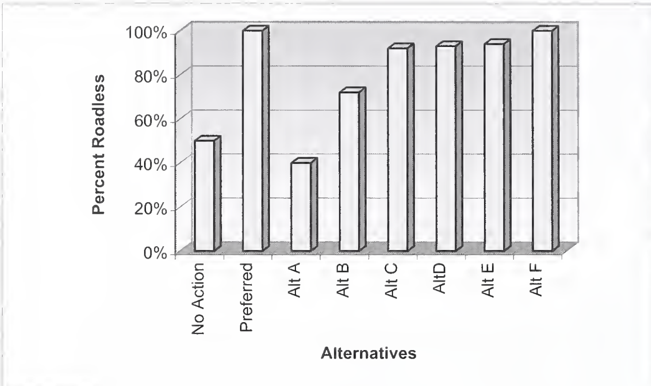
Seven of the eight alternatives recommend some acres for Wilderness designation. Alternative B recommends Wilderness only from within the Nellie Juan-College Fiord Wilderness Study Area. Alternatives C, D, E, F, the No Action Alternative and the Preferred Alternative recommend Wilderness in all the geographic areas of the Forest. Figure 2-20 displays the acres of recommended Wilderness by alternative.

Figure 2-20: Recommended Wilderness by alternative (acres).

Roadless Areas

The Chugach National Forest is approximately 99 percent roadless. The Forest currently has 16 roadless areas totaling 5,434,710 acres. Alternatives C, D, E, F, and the Preferred Alternative allocate the highest amount of roadless areas to management prescriptions that retain roadless value (Figure 2-21).

Figure 2-21: Percent of Forest roadless by alternative.



Wild and Scenic Rivers

Table 2-9b displays the number of miles of rivers recommended for inclusion in the National Wild and Scenic River System. Twenty-three streams are eligible for inclusion into the National Wild and Scenic River System. Appendix D contains the suitability reports for each of the 23 eligible rivers. Alternative F has the most miles of recommended rivers while Alternative A does not make any recommendations.

Table 2-9b: Miles of rivers recommended for inclusion in the National Wild and Scenic River System.

River Classification	Alternative: No Action	Preferred	A	B	C	D	E	F
Recreational	0	22.4	0	35.1	16.5	0	7.0	15.9
Scenic	0	19.3	0	0	73.6	68.1	83.8	99.2
Wild	0	40.7	0	0	2.0	68.3	224.9	235.2
Total	**0**	**82.4**	**0**	**35.1**	**92.1**	**136.4**	**315.7**	**350.3**

Subsistence

Subsistence hunting, fishing, trapping and gathering activities on the Chugach National Forest represent a major focus of life for many Southcentral Alaskan residents. The rural communities of Hope, Cooper Landing, Tatitlek, Whittier, Chenega Bay, and Cordova are all dependent to differing degrees on the wild resources. The three components of the Subsistence Situation are:

Is there a continued abundance and distribution of the wild resources needed for subsistence?

Continued abundance and distribution were evaluated using a two-step process. First the alternatives were screened to determine whether there could be a restriction in subsistence activities based on fish and wildlife habitat value compared to the intensity of management. Using this process Alternatives C, D, E, F and the Preferred Alternative were found to have no potential impact on the abundance and distribution of fish and wildlife. The second filter compared areas where management intensities were higher to the habitat values within specific community use areas. By rank order, Alternatives A, No Action, and B had slightly higher likelihood of a reduction of deer habitat values used by two communities, Cordova and Cooper Landing. By comparison, moose habitat enhancement opportunities are greater in Alternatives A, No Action, and B. Overall, all alternatives are expected to maintain habitat values for fish and wildlife used for subsistence activities.

Will access to subsistence resources continue to be available?

None of the alternatives limit access to public lands for the purposes of subsistence gathering activities. The Preferred Alternative proposes one area where motorized subsistence access would not be permitted. Alternatives C, D, E, and F propose two areas. These areas have low capability for both summer and winter motorized uses, due to environmental and safety factors. Such restrictions are not likely to lead to a significant possibility of a significant restriction of subsistence access to the resources.

Will management action result in an increase in competition from non-rural hunters and anglers?

Competition for wildlife and fisheries resources near rural communities results from the combination of factors. For analyzing competition, the following assumptions are made: 1) New road construction adjacent to existing road systems where inter-ties between non-rural communities exist would result in increased competition from surrounding communities associated with the inter-connected roads, and 2) New road construction adjacent to communities with ferry access would result in increased competition from outside communities. Alternatives A and B are the only Alternatives with new roads meeting these criteria. In Alternatives A and B the amount of habitat with new road access is less than one percent of available habitat. Significant restrictions to the subsistence harvest from increased competition from non-rural users are not likely.

Based on the analysis above, activities allowed under all alternatives do not present a significant possibility of a significant restriction on subsistence use of

wild resources on the Forest. This finding is based on the potential resource effects by the three evaluation categories: abundance and distribution, access, and competition.

Program Levels and Budget Allocations

Table 2-10 displays the total number of acres in management prescriptions by alternative. Table 2-11 displays the anticipated outputs under the full implementation level.

In Chapter 3, programs and effects are yearly averages for the planning horizon (50 years) at the full implementation level unless otherwise noted. Programs are based on best current information. For example, wildlife habitat improvement acres are based on the current 5-year wildlife habitat improvement program. The program activities and outcomes were adjusted depending on emphasis in the alternative.

Table 2-12 displays the budget (dollars) needed to implement each alternative and compares these levels to the current budget. The analysis used the new Budget Formulation and Execution System (BFES). Data for the analysis came from the FEIS, Interdisciplinary Team members, and the FY 2003 out-year budget request that was developed in BFES. Generally, the BFES data can be used to determine estimated unit cost for outputs. It was necessary to obtain output information for some BFES activities fro the ID Team members because not all activity outputs were specifically described in the FEIS and a full set of BFES activity outputs was required to complete the analysis (see FEIS, Appendix B, Description of the Analysis Process).

In Table 2-12 there are references to the BFES terms P1, P2, P3, and P4. Each represents a specific Forest constraint level used in the planning process. P2 was intended to represent the FY 2001 final allocation level although in reality it was slightly lower at the Forest (approximately 5 percent) because of some regional level commitments. P1 was 90 percent of P2, P3 was 125 percent of P2, and P4 was defined as monetarily unconstrained.

Conclusions Applicable to the Operational and Maintenance Activities (except Wilderness)

1. No alternative identified can be implemented at the FY 2001 funding level.
2. The Preferred and several other alternatives in the FEIS can be implemented at a 125 percent of FY 2001 funding.
3. All alternatives can be implemented at the 135 percent of FY 2001 funding.
4. Comparing the Fund Code distribution reflected in the BFES data with the need reflected in the Preferred Alternative indicates the predominate short falls are in Recreation Management, Fuels Treatment, Facilities and Trails maintenance, and Ecosystem Management.

Conclusions Applicable to the Construction and Improvement Activities

1. No alternative identified can be implemented at FY 2001 funding levels with regular funds.
2. An increase in the regional pool constraints of at least 100 percent would be required to fund the Preferred Alternative.
3. Congressional interest in providing special funding for backlog maintenance activities in programs outside this analysis may resolve some or all of the gaps between the Preferred Alternative and FY 2001 funding levels.

Table 2-10: Total number of acres in management prescriptions by alternative.

Management Prescription	Alternative							
	No Action	Preferred	A	B	C	D	E	F
111 Primitive	0	11,750	0	25,720	22,900	22,790	91,580	0
121 Wilderness Study Area	0	0	0	0	0	0	0	0
131 Recommended Wilderness	1,592,690	1,413,350	0	865,000	1,027,590	1,628,240	2,167,090	4,157,060
132 Wild River	0	12,180	0	0	140	76,650	205,340	268,540
133 501(b) - Recommended Wilderness	0	442,490	0	0	340,580	856,550	1,256,190	0
135 501(b) - 1	0	445,170	0	0	0	0	0	0
141 Research Natural Area	69,460	23,730	2,550	20,910	22,430	46,610	41,710	46,610
210 Backcountry*	0	1,818,890	0	0	0	0	0	0
211 Backcountry	529,530	0	0	363,300	1,044,870	947,890	944,560	423,990
212 Backcountry Motorized	0	0	2,044,970	1,153,270	1,177,780	653,300	195,050	137,750
213 501(b) - 2	420,890	660,940	0	1,157,180	1,213,800	631,030	294,010	0
221 EVOS Acquired Lands	102,040	102,040	102,040	102,040	102,040	102,040	102,040	102,040
231 Scenic River	0	14,270	0	0	77,770	74,560	33,620	33,620
241 Municipal Watershed	960	960	960	960	960	960	960	960
242 Brown Bear Core Area	0	70,360	18,150	29,650	29,650	113,910	0	46,960
244 Fish and Wildlife Conservation Area	108,620	260,640	29,460	64,480	142,760	208,850	122,480	236,470
312 Fish, Wildlife and Recreation	1,529,910	159,820	868,880	1,233,180	238,760	104,790	17,490	13,780
313 Backcountry Groups [2]	0	0	0	0	0 [2]	0	0	0
314 Forest Restoration	0	20,770	289,970	40,520	16,670	0	0	0
321 501(b) - 3	1,124,720	15,380	1,564,260	411,680	10,880	6,280	3,730	3,930
331 Recreational River	0	6,080	0	10,930	5,590	0	2,970	5,350
341 Developed Recreation / Reduced Noise	0	0	0	0	0	4,370	0	1,760
411 Resource Development	0	0	557,580	0	3,650	0	0	0
441 Developed Recreation Complexes	0	0	0	0	0	0	0	0
521 Minerals (site specific)	6,860	6,860	6,860	6,860	6,860	6,860	6,860	6,860
522 Major Transportation / Utility Systems (site specific)	5,900	5,900	5,900	5,900	5,900	5,900	5,900	5,900
Total	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**

[1] The Wilderness Study Area will be managed as described in this prescription until Congress removes the designation. There are 1,746,970 acres so designated.
[2] Alternative C includes 22 potential Backcountry Group sites; the Preferred Alternative includes 2 potential Backcountry Group sites.

Table 2-11: Projected outputs for key activities under full implementation level by alternative.

MANAGEMENT ACTIVITIES	Units	Base Levels	No Action	Pref	A	B	C	D	E	F
SOIL and WATER MANAGEMENT										
Soil and Water Improvements	Acres/Year		40	30	50	40	40	30	20	20
FISH MANAGEMENT										
Anadromous Habitat	Miles		82	82	82	82	82	82	82	82
	Acres		1,722	1,722	1,722	1,722	1,722	1,722	1,722	414
Riparian Zones (3-2-A)	Acres/Year		222	222	222	222	222	124	93	93
Inland Fish Habitat	Miles		0	0	0	0	0	0	0	0
	Acres		391	391	391	391	391	391	258	191
Riparian Zones (3-2-B)	Acres/Year		25	25	25	25	25	14	11	11
WILDLIFE MANAGEMENT										
Prescribed Burning	Acres/Year		2,248	2,248	2,248	2,248	2,248	1,558	910	920
Mechanical Treatment	Acres/Year		384	323	384	384	384	236	137	140
PERSONAL and COMMERCIAL TIMBER USE										
Full Implementation Funding - Even Aged Harvest	Acres/year		296	0	617	234	0	0	0	0
Full Implementation Funding - Uneven Aged Harvest	Acres/year		675	375	913	770	426	355	260	235
Total Program Quantity - Full Funding	Acres/year		971	375	1,530	1,004	426	355	260	235
	MMCF		2.23	0.43	4.18	1.93	0.43	0.31	0.25	0.23
	MMBF		9.70	1.51	19.00	8.61	1.71	1.00	0.80	0.70
MINERALS MANAGEMENT										
Plans of Operations	Plans/Year		80	80	80	80	80	80	80	80
Miles of Road Construction	Miles/Year		0	0	0	0	0	0	0	0
TRAVEL MANAGEMENT										
Total Road Miles available - End of First Decade	Miles		170	129	217	232	139	119	113	110
Total Road Miles available- Mid-decade	Miles	140	137	113	160	181	125	108	105	104
Road Construction - Miles per year	Miles/Year		6.7	3.3	11.4	10.0	2.9	2.2	1.6	1.3
Roads Construction Associated with Timber Harvest	Miles/Year		4.4	0.0	8.1	3.4	0.0	0.0	0.0	0.0
Roads Construction Associated with Facilities	Miles/Year		2.2	3.2	3.2	3.1	2.8	2.2	1.6	1.3
Other Road Construction	Miles/Year		0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0
Trails Converted to Roads	Miles/Year		0.1	0.1	0.1	1.9	0.1	0.0	0.0	0.0
Total Trail Miles - Ten Year Total										
Winter Miles Avail. (includes roads closed to hwy vehicles)	Miles	659	737	868	868	954	944	874	758	692
Motorized	Miles	345	361	639	639	686	573	405	452	426
Nonmotorized	Miles	314	376	230	230	269	371	469	306	267
Summer Miles Avail. (includes roads closed to hwy vehicles)	Miles	555	633	764	764	788	833	777	661	595
Motorized	Miles	24	52	77	77	282	135	9	6	7
Nonmotorized	Miles	531	581	688	688	505	698	768	655	589
Trail Construction	Miles/Year		7.8	21.7	20.9	23.2	27.8	22.2	10.6	4.0
RECREATION AND WILDERNESS MANAGEMENT										
Developed Capacity - End of First Decade	MM PAOT-days	1.34	1.79	1.75	1.92	1.94	1.89	1.77	1.57	1.55
Recreation Visits										
Developed Visits	MM Visits/Year	2.83	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55
Dispersed Visits	MM Visits/Year	5.31	4.69	4.36	6.60	5.56	5.37	4.64	4.00	1.61
Wilderness Visits	MM Visits/Year	0.00	1.91	2.24	0.00	1.04	1.23	1.96	2.60	4.99
Total Visits	**MM Visits/Year**	**8.14**	**10.15**	**10.15**	**10.15**	**10.15**	**10.15**	**10.15**	**10.15**	**10.15**
FUELS MANAGEMENT										
Prescribed Burning	Acres/Year		400	400	400	400	400	400	400	400

Table 2-12: Fund code distributuion by alternative for full implementation, based on BFES activities and costs.

Program Code	Total Costs No Action	Total Costs Preferred	Total Costs Alt. A	Total Costs Alt. B	Total Costs Alt. C	Total Costs Alt. D	Total Costs Alt. E	Total Costs Alt. F	FY2001 Funding w/ BFES Distribution	125% FY2001 Funding w/ BFES Distribution	FY2001 Less the Preferred	125% FY2001 Less the Preferred
Operation and Maintenance Activities [1]												
NFPN Total	$ 409,000	$ 409,000	$ 409,000	$ 409,000	$ 409,000	$ 409,000	$ 409,000	$ 409,000	$ 216,000	$ 247,000	($193,000)	($162,000)
NFIM Total	1,575,000	1,575,000	1,575,000	1,575,000	1,575,000	1,575,000	1,575,000	1,575,000	986,000	1,366,000	(589,000)	(209,000)
NFRW Total [2]	4,656,427	4,645,195	4,692,929	4,698,545	4,684,505	4,650,811	4,594,654	4,594,654	2,661,000	3,636,000	(1,984,195)	(1,009,195)
NFWF Total	2,954,544	2,951,478	2,954,544	2,954,544	2,953,522	2,996,446	2,922,862	2,845,774	2,876,000	3,875,000	(75,478)	923,522
NFTM Total	167,845	59,824	288,176	138,991	59,824	39,997	37,417	36,557	181,000	185,000	121,176	125,176
SSSS Total	0	0	0	0	0	0	0	0	0	0	0	0
NFWW Total	981,356	913,595	1,042,526	981,356	981,356	775,820	670,878	473,748	1,103,000	1,455,000	189,405	541,405
NFMG Total	471,400	471,400	471,400	471,400	471,400	471,400	471,400	471,400	541,000	617,000	69,600	145,600
NFLM Total	1,232,871	1,232,871	1,241,871	1,241,871	1,241,871	1,232,871	1,232,871	1,232,871	915,000	1,309,000	(317,871)	76,129
WFHF Total	1,049,796	1,231,200	1,241,460	1,241,460	1,238,040	1,009,886	791,251	562,205	654,000	986,000	(577,200)	(245,200)
CMRD Mnc. Total	521,240	522,440	521,240	765,754	513,160	516,280	517,520	516,280	559,000	810,000	36,560	287,560
CMTL Mnc. Total	1,188,000	1,328,000	1,320,000	1,344,000	1,388,000	1,332,000	1,216,000	1,150,000	828,920	828,920	(499,080)	(499,080)
CMFC Mnc. Total	1,623,000	1,623,000	1,623,000	1,623,000	1,623,000	1,623,000	1,623,000	1,623,000	1,235,000	1,755,000	(388,000)	132,000
Total	**$16,830,479**	**$16,963,003**	**$17,381,146**	**$17,444,921**	**$17,138,678**	**$16,632,511**	**$16,061,853**	**$15,490,489**	**$12,755,920**	**$17,069,920**	**($4,207,083)**	**$106,917**
Construction and Improvement Activities [1,3]												
CMFC Const. Total	$3,784,275	$4,058,775	$4,502,775	$4,357,775	$4,146,275	$3,751,775	$3,098,775	$2,993,775	$1,596,046	$2,039,392	($2,462,729)	($2,019,383)
CMRD Const. Total [4]	690,100	319,300	1,174,200	1,030,000	298,700	226,600	164,800	133,900	0	0	(319,300)	(319,300)
CMTL Const. Total	1,036,568	2,482,854	2,369,997	2,595,711	3,159,996	2,482,854	1,241,427	518,284	1,100,000	1,500,000	(1,382,854)	(982,854)
Total	**$5,510,943**	**$6,860,929**	**$8,046,972**	**$7,983,486**	**$7,604,971**	**$6,461,229**	**$4,505,002**	**$3,645,959**	**$2,696,046**	**$3,539,392**	**($4,164,883)**	**($3,321,537)**

[1] Negative numbers indicate shortfall in funding to implement Forest Activities.

[2] Analysis assumes additional constraint will be provided when Congress designates Wilderness Areas

[3] Construction and Improvement Funds are managed as Regional Pools

[4] Road and Facilities Pools combined Regional Constraint in FY 2003

Chapter 3–Environment and Effects

Chapter 3 – Environment and Effects

Purpose and Organization of this Chapter

Chapter 3 combines two chapters often published separately in environmental impact statements: the "Affected Environment" and the "Environmental Consequences." The primary purpose of this chapter is to describe the environments of the Chugach National Forest and to disclose the effects of the Revised Forest Plan and the alternatives on these environments.

This chapter contains a description of the physical, biological, and social environments of the Chugach National Forest and surrounding area. It is divided into five major categories:

1. Physical Elements;
2. Biological Elements;
3. Use and Designation of the Forest;
4. Production of Natural Resources; and,
5. Social and Economic Elements.

Each category is further subdivided. For example, the Physical Element is subdivided into three topic areas: air, soil, and water/riparian/wetlands. For each topic, the applicable statutory requirements, key indicators used in comparing alternatives, resource protection measures, affected environment, and environmental consequences of the alternatives are all discussed.

Many additional items were screened out of the analysis process. The reasons for eliminating them included the following:

1. analysis of the item not being considered important to the integrity of the Forest environment;
2. analysis of the item not indicating the potential for direct or indirect environmental effects; and,
3. analysis of the item not being acknowledged or required by law.

Resource Protection Measures

Mitigation measures include: (1) avoiding the impacts altogether by declining to take an action or part of an action; (2) minimizing impacts by limiting the degree or magnitude or an action or its implementation; (3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating the life of an action; and/or, (5) compensating for the impact by replacing or providing substitute resources or environments.

Environmental Consequences

Where applicable, this section first describes the effects of management area allocation or prescriptions on the environment. Next, the direct, indirect, and cumulative effects on the environment resulting from activities permitted or proposed by management area prescriptions are disclosed. It also displays the output levels, or key indicators, of this element for each of the alternatives. If a resource management activity has no direct or indirect effect on a particular element under any of the alternatives, there is no discussion.

Direct environmental effects are those that occur at the same time and place as the initial action. An example would be the on-site soil disturbance by road construction. Indirect environmental effects are caused by the action, but occur later in time or are spatially removed from the action. An example would be the downwind effect of a prescribed fire. Cumulative effects result from actions taken to achieve the goal of a particular alternative, along with past, present, and reasonable foreseeable activity, undertaken by the Forest Service or by other parties. Not all cumulative effects are disclosed at the programmatic level.

To ensure long-term productivity of the land, the environmental consequences of the alternatives are limited by several management requirements. Many requirements are founded in law, federal regulation, and Forest Service policy. Other requirements to limit the environmental consequences are called Forestwide standards and guidelines. Forestwide standards and guidelines are listed in the Revised Forest Plan. They apply to each alternative. The alternatives considered in detail, with their attending Forestwide and management area standards and guidelines, were designed to prevent or minimize environmental consequences.

Relationships Between Programmatic and Site-specific Effects Analysis

This FEIS is a programmatic document. It discloses the environmental consequences at a large scale, at the planning level. This is in contrast to analyses for site-specific projects. These decisions are made after more detailed analysis and further public comment. The FEIS presents a programmatic action at the Forest level of analysis but does not predict what will happen each time the standards and guidelines are implemented. Environmental consequences for individual, site-specific projects on the Forest are not disclosed (except for access management). The environmental consequences of individual projects will depend on the implementation of each project, the environmental conditions of each project location, and the application of the standards and guidelines in each case.

The affected environment and environmental consequences discussions in Chapter 3 allow for a reasonable prediction of consequences for any individual location on the Forest. However, the document does not describe every environmental process or condition.

Physical Elements

Air

Soils

Water/Riparian/Wetlands

Air

Introduction

The Chugach National Forest, for the most part, has remarkably pristine air quality. Alaska's Department of Environmental Conservation (ADEC) has divided the state into five Intrastate Air Quality Control Regions. The Chugach lies within two of these regions: Cook Inlet and Southcentral Alaska. The Cook Inlet Intrastate Air Quality Control Region covers about a quarter of the Forest, and comprises all watersheds flowing into Cook Inlet (for the Forest this means anything flowing into the Kenai River, or Turnagain and Knik Arms). This portion of the Forest has the greatest potential for air quality impacts from both off-site pollution sources (such as Anchorage and Kenai/Soldotna) and on-site sources (such as highway traffic, and wildland and prescribed fires). The rest of the Forest lies within the Southcentral Intrastate Air Quality Control Region where there is less potential for air quality impacts.

Legal and Administrative Framework

- The **Clean Air Act of 1977, as amended (1977, 1990)** established three air class areas. The Chugach National Forest is currently classified as Class II. The Clean Air Act requires the Forest Service to comply with all federal, state, and local air quality regulations and to ensure that all management actions conform to the State of Alaska's Implementation Plan. The Clean Air Act requires the Forest Service to evaluate all management activities to ensure that they will not:
    - cause or contribute to any violations of ambient air quality standards;
    - increase the frequency of any existing violations; or,
    - impede a state's progress in meeting their air quality goals.
- **Alaska Department of Environmental Conservation – 18 AAC 50 – Air Quality Control** are the air quality control regulations for the State of Alaska. The Chugach abides by the provisions of these regulations. The regulations set ambient air quality standards for the state (for eight contaminants), as well as allowable maximum increases to air quality.

  The Alaska Department of Environmental Conservation is the state regulatory agency responsible for air quality in Alaska. The state has the primary responsibility for enforcement of EPA's air quality standards. This responsibility is carried out through the State Implementation Plan.

Key Indicators

- Number of acres of wildland and prescribed fire
- Miles of unpaved roads
- Number of recreation visits

Resource Protection Measures

Within Class I areas, the Forest Service has specific responsibilities for protection of air quality. This responsibility is carried out through the Prevention of Significant Deterioration (PSD) permit process. Because no Class I areas are designated on the Chugach National Forest, our PSD permitting responsibilities are limited. The Forest Service will evaluate PSD permits as to potential adverse effects on sensitive receptors in Recommended Wilderness. Areas recommended for Wilderness have the greatest probability of attaining Class I status at some point in the future.

Smoke from prescribed fires is managed under a cooperative agreement between the State of Alaska and the Forest Service. Prescribed burning is planned on days when air quality degradation can be minimized. Smoke dispersion is a key consideration in any decision to implement prescribed burns. Compliance with the agreement ensures prescribed burning will not violate the State of Alaska standard for particulate matter (PM-10). An ADEC permit is required for burns greater than 40 acres.

Road dust is evaluated on projects where it is determined to be an air quality issue. Mitigation measures could include type of surface, daily time use restrictions, road closures, and the use of dust abatement products or road watering.

Affected Environment

Forestwide

Airborne dust produces the largest source of air pollution on the Forest. The greatest quantity of airborne dust is blown from natural sources, particularly floodplains of glacial rivers and tidal silt flats. This dust is most prevalent on clear, windy days in the spring and fall when stream flows are low and floodplains are dry and exposed. On some occasions the Forest receives a dusting of fine volcanic ash from volcanic eruptions coming from the Alaska Range. Most recently eruptions occurred in 1986, 1989, and 1992. An ash plume from the 1992 eruption (Crater Peak on Mt. Spurr) deposited fine particulates across much of the Forest.

Emissions from fire, including wildland fire, prescribed fire, and recreational campfires, are other sources of air pollution on the Forest.

Cook Inlet Intrastate Air Quality Control Region

About a quarter of the Forest lies within this Air Quality Control Region. This includes all Forest drainages flowing into the Kenai River, the seven watersheds

flowing into Turnagain Arm (Resurrection Creek, Sixmile Creek, Seattle/Ingram Creeks, Placer River, Portage Creek, Twentymile River, and Glacier Creek), a small piece of the Chickaloon watershed flowing into lower Turnagain Arm, and small portions of the Eagle River and Knik River watersheds flowing into Knik Arm. It is the portion of the Forest heavily impacted by spruce bark beetle infestation, and is where most prescribed burns have occurred and are most likely to be proposed. It is also the part of the Forest with by far the most available roads and vehicle traffic.

Western and northern portions of the Forest within this Air Quality Control Region may be affected by upwind urban contaminants from Anchorage and the Kenai/Soldotna area. Anchorage has been classified as a "non-attainment area" for meeting carbon monoxide standards (this non-attainment generally occurs during winter cold snaps).

Concerns have been expressed about smoke from prescribe burning on the Forest, although active complaints during burning have been minimal.

Southcentral Intrastate Air Quality Control Region

This Air Quality Control Region includes eastern three quarters of the Forest. The Forest's portion of this Region includes all of Prince William Sound and the Copper and Bering River areas. Under the 1984 Chugach Forest Plan, about 1.9 million acres in Prince William Sound were recommended for Wilderness designation. Only Wilderness designated before August 7, 1977, is currently classified as Class I under the Clean Air Act. Although all areas of the Forest are designated Class II, areas of recommended Wilderness are given special consideration if impacts to air quality are at issue.

Sources of air contamination within the Forest's portion of this Air Quality Control Region are most likely to come from communities (Valdez, Seward, and Cordova) or from marine and air traffic. No prescribed burning occurs here, and wildland fires are very infrequent due to high precipitation and cool summer temperatures. Along the Copper River and its floodplains, high particulate loads frequently impact air quality. This is due to heavy silt loads carried and deposited by the river, and high winds occurring along the river corridor.

Environmental Consequences

General Effects

None of the alternatives considered would substantially change the existing air quality on the Forest. The alternatives have few significant differences that would affect air quality. Air quality is temporarily lowered on roads and at developed recreation sites by vehicle emissions, dust, and smoke from campfires. Air quality is also temporarily lowered during burning, both by wildland and prescribed fires.

Direct and Indirect Effects

Effects from Fire Management

Table 3-1 shows the acres of burning on the Forest that could affect air quality each year by alternative.

Table 3-1: Acres burned per year by alternative.

Burning Activity	No Action	Preferred	A	B	C	D	E	F
Wildland fire	15	15	15	15	15	15	15	15
Wildlife habitat improvement burns	2,248	2,248	2,248	2,248	2,248	1,558	910	920
Slash disposal	22	22	22	22	22	22	22	22
Site preparation burns	58	23	92	60	26	21	16	14
Fuel reduction burns	400	400	400	400	400	400	400	400
Total	**2,743**	**2,708**	**2,777**	**2,745**	**2,711**	**2,016**	**1,363**	**1,371**

As displayed in Table 3-1, all alternatives are close to or below the number of acres currently being burned under the No Action Alternative. Therefore, none of the alternatives would substantially change the existing air quality on the Forest.

Acres burned by wildland fire on the Forest have been low over the last two decades, and are projected to remain low through the planning period. Projected wildland fire acres on the Forest do not vary between alternatives (average 15 acres/year). Air quality can be sharply impacted locally for days or weeks in the unusual event of a large wildland fire. Most wildfires on the Forest are quickly contained and have very limited air quality impacts.

For prescribed fires (slash disposal, wildlife habitat improvement, and fuels reduction), the No Action Alternative, the Preferred Alternative, and Alternatives A, B and C have the largest number of acres treated (about 2,700 acres/year), and have the largest potential to impact air quality. Alternative D proposes about 30 percent less prescribed burning, while Alternatives E and F both have about 60 percent less prescribed burning.

Prescribed fires generally burn at lower intensity than wildland fires and have more limited impacts to air quality. Prescribed fire air quality impacts are usually for just a few days, since the fires burn within a set area. Air quality in adjacent areas, particularly valley bottoms, can be temporarily impacted by smoke during prescribe burning. Areas that have been treated by prescribed fire would burn cooler and more sparsely than during a wildland fire. Prescribed burning (over 40 acres) is done under an ADEC permit which would help reduce the impact of any smoke to local communities.

Effects from Travel Management

Table 3-2 shows the miles of unpaved Forest roads by alternative that could affect air quality.

Table 3-2: Miles of open, unpaved road by alternative[1].

Year	Alternative							
	No Action	Preferred	A	B	C	D	E	F
2000	63	68	84	96	76	62	62	62
2005	100	75	122	143	87	71	68	68
2010	131	88	176	191	98	80	75	72

[1] Road miles displayed do not include existing paved roads; 20 percent of new roads are projected to be paved.

As displayed in Table 3-2, all alternatives would increase the total miles of open, unpaved roads on the Forest. Unpaved road mile increases over a decade would be greatest under Alternative B (95 miles), then Alternative A (92 miles), then the No Action Alternative (68 miles). All other alternatives propose between a 10 and 22-mile increase in unpaved roads over a decade. Dust impacts from roads under all alternatives would not substantially change existing air quality on the Forest except very locally and on a very intermittent basis.

Table 3-3 displays the total recreation visits by alternative that could affect air quality.

Table 3-3: Total recreation visits by alternative (in millions of visits per year).

Base Level	Alternative							
	No Action	Preferred	A	B	C	D	E	F
8.09	10.15	10.15	10.15	10.15	10.15	10.15	10.15	10.15

Since nearly all visitors drive to and on the Forest, the number of visitors provides a way to compare amounts of petroleum combustion between alternatives. Adverse air quality effects have not been encountered to date on the most heavily traveled highway routes on the Forest (the Seward and Sterling Highways). Petroleum combustion impacts from visitor use under all alternatives would not be expected to substantially change existing air quality on the Forest. Table 3-3 indicates that the number of visitors under all alternatives would increase over the base level.

Snowmobile use on the Forest is widely disbursed, and under no alternative would it be expected to produce a measurable effect on air quality. Snowmobile emissions have negative effects on air quality. Snowmobile emissions include air pollutants and volatile organic compounds. Snowmobile two-stroke engines emit about 20 to 33 percent of the consumed fuel through the exhaust (Hines 2000, USDI National Park Service 1996). Snowmobile hydrocarbon emission exceeds emissions from most other motor vehicles, with exhaust carbon dioxide levels around 1,000 times higher than an automobile operating at similar speeds (Fussell 1997). Areas available for snowmobile use vary considerably between alternatives (greatest in the Preferred Alternative and Alternatives A, B and C, and least in Alternatives E, D and F). Alternatives with limited areas open to snowmobiling could concentrate snowmobiling could concentrate snowmobile use into specific locations, causing higher air quality impacts at those locations.

Snowmobile use may degrade the air quality that currently exists within localized areas of the Chugach National Forest. Localized short-term high concentrations of carbon monoxide and other pollutants would occur where snowmobiles are used. Snowmobile use would diminish the air quality in areas where high concentrations of snowmobiles assemble. These are primarily the Turnagain Pass and Lost Lake areas.

Studies within the West Yellowstone, Montana area have found levels of snowmobile generated carbon monoxide that have exceeded federal standards. These occurrences are primarily during days of high snowmobile traffic, with over 1,000 snowmobiles moving through the National Park entrance per day, and during periods of air stagnation and temperature inversion. In comparison, use is much less and snowmobile traffic patterns are less concentrated within the Chugach National Forest. The Turnagain Pass area has the highest snowmobile use concentrations on the Forest. Use studies of motorized and nonmotorized users (Skustad 2001) have indicated significantly less use intensities compared to West Yellowstone use patterns. Maximum use counts indicated a peak of 100 vehicles per day associated with snowmobile users. Generally, use was less than 50 vehicles on weekend days. Weekday numbers averaged around 10.

Unlike West Yellowstone, the Turnagain Pass area is not in a mountain basin prone to air stagnation due to temperature inversions. Present use of the area indicates no visibility impairment (Skustad 2001). While no measurement of carbon monoxide or nitrogen oxides has been undertaken within the Forest by Chugach National Forest personnel, the relatively small number of snowmobile users in the area indicates that impacts to air quality from carbon monoxide or nitrogen oxide levels generated would be minor. This diminishment of air quality would likely be below federal standards for pollution, but additional monitoring may be needed to verify that these standards are not being exceeded.

Cumulative Effects

Cumulative effects to air quality include (1) air contaminations from urban communities (see Affected Environment section), (2) dust and vehicles emission from people traveling along federal, state, and Forest highways and roads, and (3) burning form both wildland fires and prescribes fires on Forest and adjacent federal, state and private lands, especially on the Kenai Peninsula. All areas on the Forest are currently in compliance with National Ambient Air Quality Standards. Any cumulative effect most likely would be temporary and would not be expected to substantially degrade long-term air quality on the Forest.

Air quality could be affected in the event of future oil, gas, and mineral exploration and development. Effects would be short-term, and include engine emissions from drilling activities, emissions from flaring gas during well testing, and gas release during drilling. The amount of projected development would not have a significant effect on air quality.

Soils

Introduction

Soil is the basic component of the environment. Most living things depend on the soil for their initial source of nutrients from which most other living things evolve. Soil absorbs and holds nutrient rich water, releasing it at varying rates to supply nutrients for microorganisms and plants that become the food and habitat for larger animals and people. All renewable resources on the Chugach National Forest depend on soil, which is considered a nonrenewable resource because of the long period of time it takes for its formation.

The ability of a soil to function can be described as soil health or soil quality. The Soil Science Society of America has defined "Soil Quality" as "The capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation" (SSSA 1995). "Soil Quality" also includes adequate porosity to handle water flow and organic matter to ensure aggregate stability and nutrient cycling. Before soil quality can be protected it must be recognized that there are numerous kinds of soil and that the properties of a soil affect a wide variety of ecosystems on the Forest.

The primary goal of soil management on the Forest is to maintain soil quality. This process includes inventorying soils, vegetation, and landscape characteristics to identify and locate the soils, making interpretations for appropriate Forest management activities, and assuring soil recommendations are implemented.

Legal and Administrative Framework

There are two Acts that have set the basis for the protection of soil health and quality.

- The **Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA)** requires an assessment of the present and potential productivity of the land and provides guidelines for land management plans which will insure that timber will be harvested from national forest lands where …soil, slope, or other watershed conditions will not be irreversibly damaged.
- The **National Forest Management Act of 1976 (NFMA)** amended RPA by adding sections that stressed the maintenance of productivity and the need to protect and improve the soil and water resources, and the avoidance of permanent impairment of the productive capability of the land. The specific guidelines are found in 36 CFR 219 of the Code of Federal Regulations.

Key Indicators

- Acres of disturbance from road, trail, campground, and cabin construction

Resource Protection Measures

Protection measures must be implemented in order to assure the maintenance of the soil quality and long-term productivity. These protection/mitigation measures are found in the 1984 Forest Plan, watershed analyses, environmental assessments, soil quality standards, and the Alaska Region's Best Management Practices (BMPs).

The protection measures apply to all alternatives. Once an alternative has been selected and implementation starts, monitoring will be initiated to determine if the appropriate protection measures have been implemented and if the measure is adequate. Changes in either the method of implementation or the protection measure will occur if either does not adequately protect the soil quality or productivity.

Affected Environment

Forestwide

The Chugach National Forest has used the "National Hierarchical Framework of Ecological Units" (ECOMAP 1993) as the basis for mapping landscapes, soils, and vegetation. The most appropriate levels of delineation for Forest level planning are the "Subsection" and the "Landtype Association" levels. On the Forest, the major subsection delineation criteria are climate and its relationships to the topography. There are 13 subsections on the Forest (Davidson 1997). The landtype associations are the highest level of actual landscape delineation in the ecological hierarchy. The criteria used on the Forest to delineate landtype associations have been similar geomorphic and hydrologic processes, and similar landforms, soils, and vegetation cover types. Criteria used to delineate the subsections (climate, topography, etc.) modify the landtype associations that occur within each subsection to further differentiate similar appearing landtype associations in one subsection from those in another subsection. There are eight reoccurring landtype associations on the Forest.

Organic Matter/Wetlands

Developed mineral soils on the Chugach National Forest are typically covered with an organic layer ranging from 10 centimeters on freely drained soils to greater than 40 centimeters thick on more poorly drained soils. The organic layer also insulates the mineral soil, lowering the soil temperature and sometimes reducing the productivity.

Organic layers thicker than 40 centimeters are classified as organic soils and are indicative of wetlands. Organic soils are not highly productive in regards to trees, but they do have very high values relative to fish and wildlife habitat, as well as, produce plant communities that add to the mosaic of scenic beauty throughout the Forest. The total wetlands as inventoried by the National Wetlands Inventory using the Cowardin system (Cowardin 1979) cover about 23 percent of the Forest (Table 3-7).

Soil Productivity

Soil productivity is considered a function of the inherent characteristics of the soil, the site, and the climate. It can be affected by on-site disturbance from wind, fire, natural erosion, and landslides, or it can be human related. Soil productivity varies considerably from soil to soil. Most nutrients are produced and stored in the surface organic layer and the upper horizons of the mineral soil. Soil drainage, texture, depth, water holding capacity, and site characteristics, including elevation, slope, slope position, and aspect, all determine the soil productivity. The most productive soils are moderately well drained to well drained with a moderate texture. They are found on older less active, alluvial fans and floodplains (Landtype Association 80), and on lower sideslopes, foot slopes, and terraces (Landtype Association 40). Soils on these landforms in Prince William Sound are more productive that those on the Kenai Peninsula because of more moderate temperatures and higher amounts of precipitation.

Past practices have resulted in lost soil productivity from the construction of roads, recreational trails, campgrounds, and placer mines. Impacts to the soils as a result of timber harvest activities have increased the time it takes for reforestation, because of the lack of surface soil mixing, resulting in increased plant competition. Surface disturbance that exposes a mixture of organic and mineral soil will best accelerate reforestation on the Kenai Peninsula in fine texture soils. Surface disturbance, however, is not desired on coarse texture soils. Soil compaction from over use by people or machines has also lowered or eliminated the productivity on high use sites.

Soil Erosion and Compaction

Soil erosion either from surface sheet or rill erosion and landslides reduces soil productivity. It can also result in sedimentation in streams, degrading water quality and fish habitat. Soil disturbance occurs from both human and natural causes. Too much disturbance can remove individual particles through surface erosion or remove large masses of soil through landslides resulting in the loss of the nutrient rich surface organic layer and the productive upper layers of the mineral soil. Eroded soil particles sometimes degrade the water quality in streams and lakes, or are deposited elsewhere to impact ecosystems.

Soil compaction is most prevalent in soils with finer surface textures that hold more moisture than coarser soils. Removal of the surface organic layer and repeated trampling or driving over the soil compacts the upper layers to reduce the porosity and permeability resulting in less plant cover and greater water runoff. These conditions occur most frequently on skid trails in timber harvest areas, foot trails, and adjacent to hardened campsites.

Surface erosion includes sheet, rill, gully, and stream channel bank erosion of exposed mineral soils. On the Forest, since most mineral soils are covered by moss and decayed plants, surface erosion is usually not a major concern. The five major activities that expose mineral soil are road construction, timber harvest, placer mining, recreational development, and overuse by people trampling the vegetation and exposing the soils adjacent to streams.

Mineral soil is exposed from skid trails, road surfaces, cut and fill slopes, log transfer site, and borrow sites on timber harvest sites. Most of the timber harvest on the Forest has occurred in the Cooper Landing area (early 1990s) on the Kenai Peninsula, on the Knowles Head land acquisition from the Tatitlek Native Village (1990-1995) in northeastern Prince William Sound, and on the west side on Montague Island (1970s). Monitoring past timber harvest in the Cooper Landing area resulted in 18 to 33 percent soil disturbance (Davidson 1993). The only obvious erosion after major rainfall events was restricted to the main skid trails. Visual inspection of the disturbed sites since reclamation has not identified any serious erosion. Natural revegetation has successfully invaded most sites within five years to establish a cover of greater than 75 percent, except on landings where wood chips have been spread over the sites. After five years there is still less than five percent cover on these sites.

Mineral soil exposed and compacted from over-use by people, adjacent to major fish streams and at remote campsites, is the most serious consequence to other resources (fish habitat, water quality, stream characteristics, etc.). The exposed mineral soil or stream bank then erodes during periods of high water or floods. The lower three miles of the Russian River, the Kenai River, and parts of Quartz Creek on the Kenai Peninsula have suffered the greatest erosion. Remote campsites along the major hiking trails on the Peninsula and kayak campsites in Prince William Sound have numerous locations where mineral soils have been exposed and compacted. There are about 150 impacted campsites along trails on the Kenai Peninsula of which 50 are designated as official sites (Lindquist personal communication). As of 1996 (Monz 1998) there were 63 inventoried sites in northwestern Prince William Sound with vegetation/soil disturbance that range from 9 to 225 square meters with an average of 28 square meters. There is an additional 40 sites (Twardock personal communication) that have been inventoried since 1996, but the specific data is not yet available. There are likely more sites in the Sound that have not been found or inventoried.

Placer mining for gold in numerous streams on the Kenai Peninsula has severely impacted the adjacent alluvial soils and vegetation. Most of this mining took place in the early to mid 1900s, but much evidence still remains, especially where tailings or waste areas have yet to revegetate. The most significant sites are in Resurrection, Bear, Mills, Juneau, Quartz, Crescent, Canyon, and Sixmile Creeks.

Landslides

Landslides are not a common occurrence on the Chugach Forest. They most frequently occur on slopes steeper than 72 percent (Swanston 1997) in soils that have a layer restrictive to downward water flow. This restrictive layer is usually bedrock or compact till. Landslides are also common in clay/silt lacustrine (lake bottom) sediments. Landslides that occur as a result of human activities are caused by roads that cut a portion of the retaining slope, the concentration of water on otherwise stable slopes, timber harvest on shallow soils over bedrock on slopes upwards to 90 percent or more, and road construction over unstable soils on steep slopes when they are saturated. Natural landslides have been

identified in the Knowles Head area in northeastern Prince William Sound, Montague Island, and scattered across the Kenai Peninsula. All of these areas have some slides that may have resulted from previous management activities.

Environmental Consequences

General Effects

General effects on the soil productivity are the result of either the removal or the change in the physical characteristics of the upper organic and mineral productive layers. Usually, the greater the disturbance the greater and longer lasting the impact on soil productivity. Management activities that purposely remove the vegetation and the upper soil layer, result in the elimination of soil productivity. These activities include construction of roads, trails, gravel pits, parking areas, and administrative facilities. Less impacting activities that do not intentionally remove the soil are those that kill the protective vegetation and change the soil structure (compaction, etc.). These activities include skid trails in timber harvest units, recreational cabin and campsites, primitive trails, and peripheral areas adjacent to campgrounds, viewing sites, and other recreational attractions. Development of access routes to remote sites that attract users to streams and wetlands accelerate impacts to stream banks, and the fragile organic soils in the wetlands.

The Revised Forest Plan, through management area prescriptions, allocates uses for different parcels of land, and uses standards and guidelines, to direct how these activities are to be implemented. Through responsible Forest management, disturbance/ impacts to the soil will be kept to a minimum. Different prescriptions permit different activities. Some prescriptions permit timber harvest and others permit recreational development. Most disturbances that result from timber harvest are usually associated with road construction and maintenance. Disturbance associated with recreation is usually associated with road and facility construction and from overuse caused by people. Development of numerous small recreation sites could have a cumulative effect far greater that a timber sale on disturbance of the soil. By following standards and guidelines and Best Management Practices, impacts to soils would be minimized. Since site-specific activities are not identified at the Forest Plan level, the discussion of environmental consequences will deal with those management activities allowed by the prescriptions and how they might disturb the soil.

Direct and Indirect Effects

Effects from Timber Harvest

All alternatives would allow the harvest some acreage for firewood and hazard tree removal. Firewood/hazard tree sales are proposed within a mile of existing road systems and would generally treat any given acre lightly, that is, most of the trees would be left standing. Only Alternatives A, B and the No Action Alternative include commercial timber harvest. Alternative A would allow nearly twice the acreage of commercial timber harvest than the next closest alternative, the No Action Alternative. Alternative B would harvest just over a third as many acres as

Alternative A. Harvest techniques and locations would not vary significantly between these alternatives.

Continuous strips of exposed mineral soil would reduce the productivity and allow for erosion. Timber harvest would affect the soil directly through skidding, decking or transfer sites, and site preparation for reforestation. Skid trails would compact soil or remove the upper, nutrient rich, soil layers. Dispersed ground skidding in the harvest area would expose patches of mineral soil by mixing the upper mineral and organic soil layers during harvest which reduces vegetative competition and aids in natural reforestation, or it provides planting sites for induced reforestation.

Timber harvest would indirectly affect the next generation of plant communities, because of the amount and intensity of surface disturbance. Thus the amount of soil disturbance would have an indirect effect on the type and quality of wildlife habitat and species that depend on a forested plant community.

Effects from Roads

Road construction ranges from 1.3 miles per year under Alternative F to 11.4 miles under Alternative A. Alternatives A and B would have the most new road construction. The No Action Alternative would have slightly more than half of the miles of new road construction as Alternatives A and B. In descending order, the Preferred Alternative, Alternatives C, D, E, and Alternative F would all have substantially less proposed road miles. Table 3-4 shows the long- and short-term effects of road construction on the soil productivity by alternative.

Table 3-4: Long- and short- term effects on soil productivity from road construction (acres) – first decade.

Management Activities	Alternative								
	Existing	No Action	Preferred	A	B	C	D	E	F
Timber Harvest Roads (1)	0 0	75 75	0 0	138 138	58 58	0 0	0 0	0 0	0 0
Roads for Facilities (2)	67 60	42 37	61 54	61 54	59 53	53 48	42 37	30 27	25 22
Other Road Construction (3)	106 95	0 0	0 0	0 0	30 27	0 0	0 0	0 0	0 0
Trails Converted to Roads	0 0	2 2	2 2	2 2	36 32	2 2	0 0	0 0	0 0
Total Potential Disturbance from Roads	**173** **155**	**119** **114**	**63** **56**	**201** **194**	**183** **170**	**55** **50**	**42** **37**	**30** **27**	**25** **22**

(1) Calculations based on a 14-foot wide running surface (top line, 1.7 acres of long term disturbance per mile) and 7-foot fill and cut slope (bottom line, 1.7 acres of short term disturbance per mile) on either side of the road.
(2) Calculations based on a 16-foot wide running surface (top line, 1.9 acres of disturbance per mile) and 7-foot fill and cut slope (bottom line, 1.7 acres of short term disturbance per mile) on either side of the road.
(3) Assume road design similar to that under Roads for Facilities (2).

The construction of roads provides the potential for soil disturbance and a loss in soil productivity in all of the alternatives. Alternative A provides the largest potential for disturbance with the potential long-term loss of soil productivity from road construction on 201 acres and a shorter-term reduction in soil productivity of 194 acres. A majority of the disturbance would come from the construction of

roads for proposed timber harvest. Alternative B would have soil disturbance on 183 and 170 acres. A majority of the disturbance would come from roads constructed for recreational or facility access. Alternative F would have the smallest potential for the disturbance from road construction with the potential long-term loss in soil productivity of 25 acres and a shorter-term reduction of 22 acres. There would be a total of 63 acres of long-term soil disturbance and 56 acres of short-term disturbance under the Preferred Alternative. This is much less than Alternatives No Action, A, and B, but greater than Alternatives C, D, E, and F.

The travel surface of roads eliminates the soil productivity (long-term). The cut and fill slopes or borrow ditches reduce the productivity (short-term) for the time period it takes for vegetation to reestablish to the pre-disturbance state. Roads that are associated with timber harvest and mining are usually temporary, and remove the soil productivity while they are in use. They are usually obliterated and allowed to revegetate upon completion of the timber harvest. Stockpiled topsoil can be spread to accelerate revegetation once the road has been closed. Roads that are used as access to permanent recreation or administration facilities (campgrounds, work centers, trail heads, etc.) permanently remove the productivity of the soil.

An indirect effect resulting from the construction of roads is the tendency of unwanted plant species and weeds to invade areas of substantial soil disturbance such as road cuts and fills, or to revegetate seed mixtures that do not include species indigenous to the specific areas.

Effects from Trails

Trail construction varies from 4.0 miles per year under Alternative F, to 22.6 miles per year under Alternative C. The Preferred Alternative and Alternatives C, D, B, and A would have the most new trail construction. Alternative E, the No Action Alternative, and Alternative F would have the least trail construction. The construction of recreational trails, both motorized and nonmotorized, would result in soil disturbance and a loss in soil productivity similar to that of roads. There is less linear disturbance per mile with trails. Table 3-5 gives an estimate of the loss in soil productivity for trail construction for each of the alternatives.

Table 3-5: Long- and short-term effects on soil productivity from trail construction (acres) – first decade.

Management Activities	Existing Trail Disturbance	No Action	Preferred	A	B	C	D	E	F
	Alternative								
Summer Trails (1)	11	31	46	46	169	81	5	4	4
Motorized (2)	14	38	56	56	206	99	7	4	5
Summer Trails (3)	256	279	330	330	242	335	369	314	283
Nonmotorized (2)	389	424	502	502	369	510	561	478	430
Total Potential Disturbance for Trails	**267** **403**	**310** **462**	**376** **558**	**376** **558**	**411** **575**	**416** **609**	**374** **568**	**318** **482**	**287** **435**

(1) Calculations based on a 5-foot wide running surface (0.6-acre long-term disturbance per mile).
(2) Calculations based on a 3-foot cut and a 3-foot fill average for the trail (0.73-acre short-term disturbance per mile).
(3) Calculations based on a 4-foot wide walking surface (0.48-acre long-term disturbance per mile).

Presently, there are 267 acres where existing trails have eliminated the soil productivity on the Forest, for the long term. Alternative C proposes the largest amount of disturbance from trail construction with a long-term loss in soil productivity of 416 acres and a short-term reduction of the area adjacent to the trails of 609 acres. Alternative F would have the smallest potential for the disturbance from trail construction with a long-term loss in soil productivity of 287 acres and a short-term reduction of 435 acres. There would be a total of 376 acres of long-term disturbance and 558 acres of short-term disturbance from trail construction under the Preferred Alternative. This is the same amount of disturbance under Alternative A and slightly less disturbance as under Alternatives C and D.

In all of the alternatives, proposed trail construction would disturb an area larger than that from road construction. This is especially true in the Preferred Alternative and Alternatives D, E and F. In Alternative A, which has the largest proposed amount of road construction, there would be more than twice the soil disturbance from trail construction than from roads.

Many of the prescriptions allow for a variety of recreational development or subsistence use. The wilderness prescriptions allow for trail development, motorized access for subsistence, hardened dispersed campsites, conditional mineral entry, and the construction of Forest Service recreational cabins. All of these activities tend to concentrate people. An indirect consequence would result from overuse by people such as trampling of the stream banks of high use fishing rivers, trail development in fragile wetlands, and the establishment of non-developed campsites. This would eventually result in killing the vegetation allowing for erosion, sedimentation to streams, and a loss in soil productivity.

Effects from Recreation

Campgrounds, day use facilities, administrative sites, parking lots, and viewing sites are usually planned to remain for the long term. These sites have associated permanent roads, vehicle parking, and intensive use areas. The disturbance caused by the roads is included in Table 3-4. Table 3-6 includes the

loss in soil productivity attributed to the campsites and cabin areas and the area trampled by use.

Table 3-6: Effects on soil productivity from campsite and cabin construction (acres) – first decade.

Recreational Use	Existing Disturbance	Alternative							
		No Action	Preferred	A	B	C	D	E	F
Campsites (1)	6.8	3.0	3.5	5.1	5.8	5.8	5.0	3.2	2.7
Cabins (2)	1.0	0.7	0.7	1.0	1.0	1.0	0.8	0.7	0.2
Total Disturbance	**7.8**	**3.7**	**4.2**	**6.1**	**6.8**	**6.8**	**5.8**	**3.2**	**2.9**

(1) Disturbance estimated using 400 square feet for each campsite and 300 square feet for the access trail (100 feet long by 3 feet wide).
(2) Disturbance estimated using 1000 square feet for each cabin. (The area of disturbance for access trail is included in the trails table.)

Alternatives B and C would have the greatest amount of disturbance with a total of about 6.8 acres, and Alternative F would have the least amount of disturbance with only 2.9 acres. An indirect effect from the camp cabin sites, especially in Prince William Sound and the Copper River area, would be the tendency for adventurers to make trails in wetlands and other fragile areas.

Effects from Fires

In most instances, wildland or prescribed fires would not burn hot enough to remove enough of the organic surface layer to cause a potential for soil erosion. Long duration smoldering in tree roots would burn through the organic layer, but these sites are usually small in size. This could reduce the thickness of the organic layer and the density of the canopy that would allow the soils warm somewhat and stimulate an increase in biological activity and accelerate plant growth.

Effects from Mineral Development

Mining, both on the surface and underground, eliminates the soil productivity for the area where the soil is removed and the area where the tailings are placed. Normal practices require the stockpiling of the topsoil that would accelerate revegetation and restore some of the soil productivity once the mining has been completed and the topsoil has been replaced. There would be minimum effects from oil and gas development due to the low number of projected wells (one).

Cumulative Effects

Cumulative effects represent the loss in soil productivity that would occur at the completion of the ten-year planning period after full implementation of soil disturbing activities. Cumulative effects include the amount of long and short-term soil disturbance from potential road construction to support timber harvest and recreational facilities, and summer use trails. For analysis, the Forest was divided into three areas: the Kenai Peninsula, Prince William Sound, and the Copper River Delta. The assumptions used to determine the amount of disturbance are the same as used in the direct effects analysis (Tables 3-4, 3-5 and 3-6). Soil disturbance from the construction of camp and cabin sites would

be insignificant when compared to the roads and trails, and therefore, it has not been included in the analysis.

Cumulative effects to soil disturbance/soil productivity are displayed in Figures 3-l and 3-2. Generally, the short-term soil disturbance would be equal to or greater than the long-term disturbance. Road construction for timber activities accounts for the smallest amount of soil disturbance under each of the alternatives. Roads that support recreational activities account for the next largest amount of soil disturbance, especially on the Kenai Peninsula. Road construction accounts for the greatest amount of disturbance on the Kenai Peninsula with lesser amounts on the Copper River Delta. None is projected for Prince William Sound. Trail construction would account for the greatest amount of long and short-term disturbance in all three areas, with the greatest effect on the Kenai Peninsula. The soil disturbance that would occur from the potential construction of trails exceeds the total disturbance from the construction of roads in all of the alternatives except in Alternative B, where there would be greater disturbance from roads proposed for recreational development than trails on the Kenai Peninsula. Of all the alternatives, the Preferred Alternative proposes the greatest amount of disturbance from trail construction on the Kenai Peninsula. Even though the cumulative disturbance would exceed two square miles in some cases, it accounts for a very small amount of the entire accessible portion of the Forest.

Figure 3-1: Total short-term soil disturbance from recreation and timber roads and trails by geographic area.

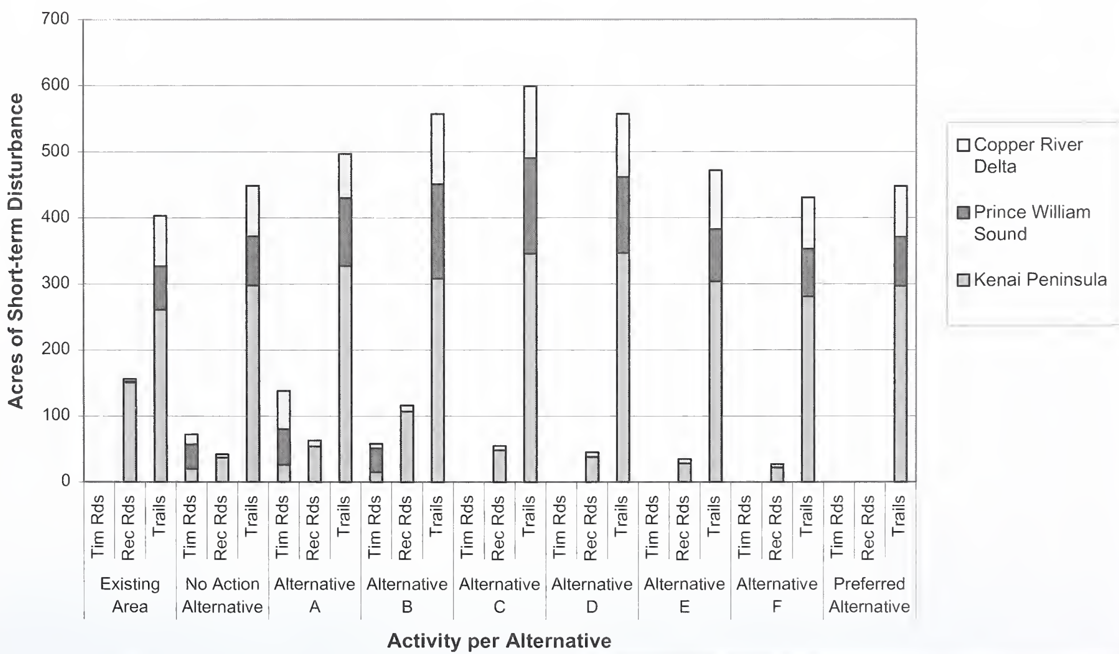
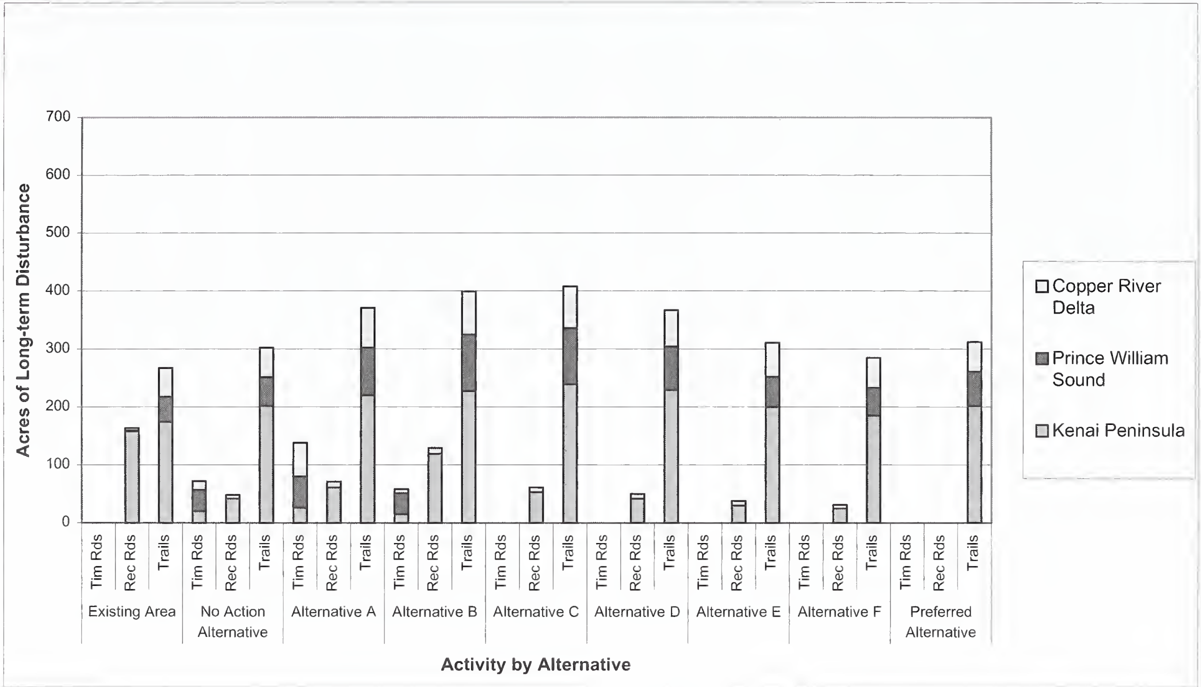


Figure 3-2: Total long-term soil disturbance from recreation and timber roads and trails by geographic area.



Water/Riparian/Wetlands

Introduction

The Chugach National Forest, situated along the Gulf of Alaska's northern coast, has abundant water resources. Frequent storms trending eastward across the North Pacific Ocean encounter the Forest's Chugach Mountains, and drop copious quantities of rain and snow. Glaciers are present over about a third of the Forest, and require heavy precipitation and/or cool year-round temperatures in order to persist. Many thousands of lakes dot the Forest, the largest being Kenai Lake (14,000 acres.) Average annual precipitation for the Forest is around 100 inches, but varies locally from 20 inches to over 300 inches. Snow's contribution to the annual precipitation varies from less than 50 percent in low-lying coastal areas, to 100 percent in the highest mountain regions. Precipitation runoff, within streams, wetlands and forests, is a critical medium for both fish and wildlife species. Use of the waters on the Forest for development and human consumption purposes is limited.

The Chugach is somewhat unique among national forests in that hundreds of its streams flow directly into the Pacific Ocean. Most of these stream systems in near pristine condition. Forest drainages flowing to the ocean vary in size from the 24,000-square-mile Copper River basin and the 2,200-square-mile Kenai River basin, down to tiny first order drainages. For some of these drainages, only a portion lies within the Forest boundary.

The Forest can be divided roughly into three hydrologic units: Cook Inlet, Prince William Sound/Outer Coast, and Copper and Bering River system complexes. In general, the Prince William Sound/Outer Coast unit receives the greatest amount of precipitation and has the highest streamflows per square mile, while the Cook Inlet unit has the lowest amount.

Forest runoff is predominantly high-quality surface water. The exception is runoff from glacial drainages, which carries naturally high sediment loads. Surface and ground water from the Forest is put to use both consumptively (mining, hatcheries, drinking water and other domestic uses) and non-consumptively (fish, visual aesthetics, recreation). Management activities on the Forest that have the potential to affect water timing, quantity and quality and the overall watershed condition include recreation, mining, timber management, road construction, hydropower development, oil, gas, and mineral exploration/ extraction, and intensive developed recreation.

The Forest protects watershed conditions and water quality through the use of Best Management Practices (BMPs) as prescribed in the Alaska Region Soil and Water Conservation Practices handbook (FSH 2509.22). These practices reduce to the extent feasible, nonpoint sources or pollution (silviculture and mining for example). For forestry activities, the Forest Service must meet or exceed the requirements of the Alaska Forest Resources and Practices Act and regulations. Other activities on the Forest, must meet the requirements of the State of Alaska Water Quality Standards and Drinking Water Standards.

Legal and Administrative Framework

- The **Organic Administration Act of 1897 (16 USC 475)** states that one of the purposes for which the national forests were established was to provide for favorable conditions of water flow.
- The **Federal Water Pollution Control Act, (Clean Water Act) as amended**, intends to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Required are: (1) compliance with state and other federal pollution control rules to the same extent of nongovernmental entities, (2) in stream water quality criteria needed to support designated uses, (3) control of nonpoint source water pollution by using conservation or "best management practices," (4) permits to control discharge of pollutants into waters of the United States.
- The **Sustained Yield Forest Management Act of 1944 and the Multiple Use Sustained Yield Act of 1960** allow for the production of multiple quality goods and services at sustained levels over time, including maintenance of water supply.
- The **Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA),** known as the Resource Planning Act (RPA), requires an assessment of present and potential productivity of the land. The act contains many references to suitability and capability of specific land areas, to maintenance of productivity of the land, and the need to protect and, where appropriate, improve the quality of the soil and water resources. The act specifies that substantial and permanent impairment of productivity must be avoided and has far-reaching implications for watershed management (including monitoring, inventories, condition and trends, and support services) on national forests.
- The **National Forest Management Act of 1976 (NFMA)** prevents watershed conditions from being irreversibly damaged and protects streams and wetlands from detrimental impacts. Land productivity must be preserved. Fish habitat must support a minimum number of reproductive individuals and be well distributed to allow interaction between populations.
- The **Safe Drinking Water Act Amendment of 1996** provides the states with more resources and authority to enact the Safe Drinking Water Act of 1977. This amendment directs the states to identify source areas for public water supplies that serve at least 25 people or 15 connections at least 60 days a year.

- The **Corps of Engineers Regulations for Permits for Dredge and Fill Material into Waters of the United States** establishes the guidelines for obtaining permits when activities will affect not only rivers/streams but also wetlands. The **Wetland Delineation Manual (Army Corps of Engineers 1987)** provides the standards for determining areas of wetlands. Land areas are defined as wetlands when soil, hydrology, and vegetation all meet the technical criteria for establishment.

- **Executive Order 11988** directs federal agencies to provide leadership and take action on federal lands to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are required to avoid the direct or indirect support of development on floodplains whenever there are practicable alternatives and evaluate the potential effects of any proposed action on floodplains.

- **Executive Order 11990, as amended,** requires federal agencies exercising statutory authority and leadership over federal lands to avoid to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Where practicable, direct or indirect support of new construction in wetlands must be avoided. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands. Other laws pertinent to watershed management on National Forest System lands can be found in Forest Service Manual 2501.1.

Regulations have been developed in support of laws listed above. The regulations require:

- protection of surface resources and productivity from all natural resource management activities; and,

- limitations of resource use to protect watershed condition.

Other laws pertinent to watershed management on National Forest System lands can be found in Forest Service Manual 2501.1 and Appendix D.

Key Indicators

- Miles of new road and trail construction

- Acres disturbed by roads, trails, timber harvest, fire, campsites and campgrounds, and mineral development

- Number of recreation visits

Resource Protection Measures

Healthy watersheds provide for good water quality and stream channels that maintain a dynamic equilibrium between sediment and water inputs. Natural disturbance processes, such as landslides, fires, flooding, and wind throw, are part of the dynamic equilibrium of each watershed and channel. This dynamic equilibrium can be changed through management activities that alter the balance between sediment and water inputs in a watershed. Where activities occur once (pulse events), a watershed/channel may recover to its dynamic equilibrium. Where management activities occur continuously (pressed events), the watershed/channel may or may not return to its dynamic equilibrium depending on the physical features of the watershed/channel.

Watershed/channel condition will be protected by limiting disturbance in each watershed to levels that safeguard the integrity of stream flow, fluvial systems, and water quality. In addition to limiting the amount of disturbance within a particular watershed, the use of BMPs will be used to protect the integrity of watersheds. Remedial projects will be proposed, planned, and implemented to restore watershed health if watersheds are at risk or near tolerance levels.

Executive Orders 11988 and 11990 require federal agencies to take action to protect riparian and wetlands. Timber sale and other contracts and permits have provisions protecting streams and water quality, such as stream course protection, erosion control, operating season, and temporary roads.

Watershed Improvement Needs

Watershed improvement planning entails watershed condition assessment that identifies the causes of degradation and resource coordination necessary for developing a plan to improve the watershed condition. The Forest is in the process of identifying high priority watersheds for restoration work. Of particular note are historic mining sites, old and "ghost" roads, intensive recreation sites, and past timber operations which impacted streamside zones. Historic mining sites needing restoration include both placer gold sites (usually within streamside zones), and lode mining sites, which are more likely to occur on uplands. Projects will focus on restoring the natural drainage pattern of a watershed to the extent feasible and reducing the connected disturbed areas. Specific projects will be identified during Watershed Condition Assessments and documented in Watershed Restoration Plans. Monitoring will be conducted following project implementation to track the effectiveness of the restoration work.

Affected Environment

Watersheds

The Chugach National Forest is subdivided into 94 watershed associations. These watershed associations range in size from 30 to 240 square miles, and are about the size of 5th level watersheds under the Natural Resources Conservation Service (NRCS) hydrologic unit code (HUC) program. The boundaries for the Chugach National Forest's watershed associations do not

meet the national and State of Alaska protocols for 5th level watersheds. The national and state delineation protocols for 5th and 6th level hydrologic units are still in draft form, but are currently being used with national acceptance. The Forest is in the process of mapping and digitizing the 5th and 6th level watersheds, using the national and state protocols. Under these protocols, 5th level watersheds range in size from 40,000 to 100,000 acres, and 6th level watersheds from 10,000 to 40,000 acres. Based on initial mapping, the Chugach National Forest covers approximately 50 fifth level watersheds, and 180 sixth level watersheds. Once digitized and reviewed by NRCS, these 5th and 6th level watersheds will be used in future planning efforts on the Forest.

The existing condition of watersheds (watershed health) on the Forest varies depending upon amount of disturbance found within each watershed and the degree of natural integrity of the system. Disturbance in the form of land management activities, such as timber management, road construction, mining, recreation, and special-uses, can adversely affect a watershed's condition.

Past management activities have been concentrated within certain watershed associations. Most watershed associations on the Forest are virtually untouched by roads or large-scale management activities, and retain pristine watershed characteristics. Management activities have been most concentrated within watershed associations flowing into Cook Inlet. Also, several watershed associations in Prince William Sound have had timber harvest activities, some showing restoration needs. Management activity effects are influenced in part by the local terrain, the precipitation regime, and the potential geohazards.

Surface Water

Approximately 9,600 miles of perennial stream channels flow through the Forest. Most of these channels are home to fish species. The Forest also has 11,285 lakes totaling over 110,000 acres. Surface waters on the Forest originate as runoff from snowmelt, rainfall, and glacial melt, yielding approximately 40 million acre-feet of water per year off Forest lands. Snowfall is generally the greatest contributor to total runoff, while intense rainfall events usually cause the largest floods. The majority of watershed associations on the Forest have some component of glacial drainage. Glaciers on the Forest, though still very much present, have been diminishing in size over the last 100 years, releasing stored water as they melt. As glacial retreat continues, the amount for runoff from glacial melt diminishes.

The major runoff season on the Forest is from May through October, with generally in excess of 80 percent of the annual runoff occurring during these six months. Snowmelt runoff peaks usually occur from late May into June, while streams with a strong glacial component generally show their melt peaks from late June to mid-August. The largest flood peaks generally occur on major rainfall events in the late summer and early fall. Lowest flows generally occur in February through early April.

Surface water quality

Surface waters on the Forest have very limited impacts from human sources of contamination. That is to say, water quality is "good." The most persistent "impact" to water quality is from stream sediment loading. In most cases, sediment loads are generated by natural sources, primarily glacial runoff, and also materials carried into streams by mass wasting and bank erosion. As glaciers move, they grind and tear at the bedrock below, producing a huge sediment source for streams draining them. On steep mountain slopes, gravity is constantly pulling sediments from the slopes down towards the stream. Management related stream sedimentation also occurs on the Forest, relating to such activities and features as roads, skid trails, mining, and intensive recreation activities in and near streams.

Other water pollutants that can be of concern on Forest streams and lakes include: fecal coliform from human waste, petroleum and other lubricants from roads and heavy equipment operations near creeks, and acid drainage from past hardrock mining operations.

Section 305(b) of the Clean Water Act (CWA) requires states prepare and submit every two years a water quality summary report to the U.S. Environmental Protection Agency (EPA). In addition, CWA Section 303(d) requires states to submit to EPA lists of waterbodies that meet 303(d) listing criteria. This list, produced by the Alaska Department of Environmental Conservation, identifies water quality-limited waterbodies. Water quality impacts can be from point and/or nonpoint sources of pollution, and may require additional controls to meet state water quality standards. These waterbodies are prioritized based on the severity of the pollution and other factors. Currently, no Chugach National Forest waterbodies are designated as impaired on the state's Section 303(d) list.

The Alaska's Water Quality Assessment Report is updated every two years. Stream segments may be added or removed from the impairment list as more information becomes available. Analysis for proposed Forest projects will consider the potential effects of management activities on water quality. Measures will be implemented to prevent degradation.

Areas of the Forest have had historic surface and subsurface mining, primarily for gold and to a lesser extent for copper. Gravel and rip-rap is also mined on the Forest, primarily for road construction, and generally from highway and/or railroad accessible sources.

Quality of surface water is affected by the integrity of the fluvial system and aquatic habitat. The integrity of fluvial systems on the Forest is exceptionally good. Some concerns exist for watersheds where mining, timber management, and/or riparian recreation have affected stream channel potential, including riparian condition and streambank stability. These effects are in limited locations, and changes in management could improve existing conditions.

Surface water uses

Surface water from the Forest is used both consumptively and nonconsumptively. Uses in both categories depend on high quality water.

Nonconsumptive water uses include recreation, wildlife, fisheries, and the aesthetic quality of this resource. Value on the Forest is high for these uses. Much of the recreation use on the Forest revolves around waterbodies and glaciers, including sightseeing, camping, fishing, and boating. Most campgrounds on the Forest are located near lakes and streams.

Consumptive water uses include hydropower generation, fish hatcheries, mining operations, drinking water, highway construction, dust abatement, and special use permits. Consumptive uses are presently only a very small percentage of the total outflow from the Forest. The City of Cordova has three municipal watersheds it uses for water supply. Portions of two of these watersheds, Heney Creek and Murcheson Falls Creek, lie on national forest lands. These have been selected by the State of Alaska, and are likely to be conveyed in the future. No other municipal watersheds are located on the Forest, although several communities use wells that are recharged by surface water off national forest lands. Most notable is the City of Seward, which uses high production wells recharged by the Resurrection River. The City of Whittier also uses a municipal well that is recharged by Whittier Creek, which originates on the Forest. Alyeska Ski Area, although located entirely off the Forest, uses water from Glacier Creek for snow making in the winter. The Glacier Creek watershed originates on National Forest System lands.

Four hydroelectric power projects draw water from watersheds lying in part on Forest lands. These include the Cooper Lake Project near Cooper Landing, and Humpback Creek and Power Creek near Cordova, and Solomon Gulch near Valdez. The Cooper Lake Project stores inflow to Cooper Lake and diverts it out of the watershed down to Kenai Lake for power production. The two Cordova projects are basically “run of the river” with minimal storage and no water diversion from the watersheds. The Power Creek Project is under construction and slated for power production in 2002. Solomon Gulch has only a small portion of its upper watershed on Chugach National Forest lands. Several additional sites on or adjacent to the Forest are currently being considered for hydropower development.

Five fish hatcheries are located on or near the Forest, and draw water wholly or in part from Forest watersheds. The Main Bay and Cannery Creek hatcheries use watersheds entirely on Forest lands. The Esther Creek watershed that lies primarily on Forest lands feeds Esther hatchery. The San Juan Bay hatchery has a small portion of its watershed (about 40 acres) on Forest lands, while the Trail Lakes hatchery uses wells that are recharged by Moose Creek, portions of which lie on Forest lands.

Surface water protection measures

Public water supplies are protected by the Safe Drinking Water Act (SDWA), which was amended in 1996. The SDWA does not require source areas to deliver water of potable quality with no need for treatment. In fact, waters in pristine areas usually need treatment due to natural waterborne parasites, such as giardia. The Forest Service will work with the State of Alaska to identify public supply watersheds and sources of contamination.

The Alaska Region's Soil and Water Conservation Handbook (FSH 2509.22) contains 75 Best Management Practices (BMPs) to protect water quality in compliance with the Clean Water Act. BMPs in the Handbook cover a wide variety of land management actions on National Forest System lands, including watershed management, timber, transportation and facilities, pesticide-use, recreation, minerals, fish and wildlife habitat, and fire suppression and fuels management.

When BMPs are properly applied, pollutant delivery to streams and lakes is minimal and recovery of waters and aquatic sites should be rapid. The physical, chemical, and biological integrity of waters in all watersheds should be as good as in watersheds that are managed exclusively for domestic and municipal supplies.

Water developments which are used off-Forest but have some facilities located on National Forest System lands are administered with special use authorizations. They involve water storage, transmission, or diversion facilities. Stipulations may be added to the authorizing document, which ensures the quantity of water needed to fulfill the purposes of the Chugach National Forest and for environmental instream needs is identified. As special use permits are amended, renewed, or issued, the Forest will analyze environmental effects and ascertain if mitigation or new terms and conditions are required to meet the standards and guidelines of the Revised Forest Plan. The Forest Service has statutory responsibility for all existing permits, rights-of-way, and grants of easement located on National Forest System lands, including their administration, amendment, and renewal, when authorized and appropriate.

Groundwater

Rainfall and snowmelt, as well as producing surface runoff, also recharge groundwater sources on the Forest. Groundwater aquifers release water during periods of low precipitation to maintain base flows of streams. Groundwater seeps and springs are in some cases vitally important in providing habitat for over-wintering salmon eggs and fry. Groundwater is of beneficial use both on and off-Forest, in the form of water supply wells. Communities of Seward and Whittier use groundwater for part or all of their municipal water supply, while Cooper Landing and Moose Pass residents use individual domestic wells.

Consumptive use of groundwater on the Forest is low. Such use is limited to special-use permittees and Forest Service campgrounds and administrative sites with domestic wells. The existing condition of groundwater on the Forest is good, although not all wells provide high quality drinking water. Past management activities on the Forest do not appear to have adversely affected groundwater quality, however, elevated levels of trace and heavy metals have been sampled in several old hard rock mine adits. Activities such as oil/gas/coal exploration and leasing on the Forest have been very limited. Other potential adverse effects from wastewater treatment and other equipment spills have been limited. No groundwater contamination from recreation uses (toilets) has been recorded, with all road-accessible toilets being of the pump-vault type. Some potential for

such ground water contamination exists at heavily used recreation sites with limited facilities, like the lower Russian River.

Riparian Areas

Riparian areas are the transition zone between uplands and water in lakes and rivers. Riparian ecosystems are characterized by the presence of trees, shrubs, or herbaceous vegetation that require free or unbound water, or conditions that are moister than those of surrounding areas. Riparian ecosystems, aquatic ecosystems, wetlands, lakeside zones, and floodplains will be jointly referred to as riparian areas. The terms riparian zones and riparian areas are used interchangeably, but by strict ecological definition, may not be the same in all instances.

Vegetated lands on the Forest are often lacking in sharp distinction as to where riparian ecosystems start and end. Riparian ecosystems are most easily delineated in regions with limited water availability. However, water (precipitation) is generally very abundant on the Forest. Annual precipitation exceeds losses to transpiration and evaporation on all areas of the Forest, often by very large percentages. Moisture availability is infrequently a limiting factor except on well-drained sites.

Traditionally, stream and lakeside zones are the areas most likely to be mapped as riparian. On the Chugach, sharp changes in vegetation are many times lacking in cross sections of the streamside zone. When vegetation distinctions are apparent, they are often more related to flood disturbance than to moisture availability. To date, riparian areas on the Forest have not been mapped or specifically defined. The Forest Service planning regulations require that consideration be given to the land and vegetation for approximately 100 feet from the edges of perennial streams, lakes, and other bodies of water. This requirement is intended to protect stream water quality (primarily sedimentation) from adverse effects of timber harvest.

High water availability on the Forest also results in a great abundance and variety of wetlands. Wetlands are defined in the 1987 Corps of Engineers Wetlands Delineation Manual (USDD Army Corps of Engineers 1989) as:

> "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Riparian ecosystems are generally inclusive of wetlands. Healthy riparian areas, with an abundance of trees and other vegetation, slow flood waters and reduce the likelihood of downstream flooding. Riparian areas improve water quality by filtering runoff and sediment from flood flows and adjacent upland slopes. Healthy riparian areas act like a sponge, absorbing water readily during periods of excess. Water slowed by riparian areas enters the groundwater. Some of it is released later, increasing late summer and fall streamflow. Riparian areas produce an abundance of stream cover and shade, which in turn limit the amount

water temperature fluctuation on the stream. This limiting in water temperature is generally advantageous to cold-water fish species.

Benefits provided by riparian areas include food, cover, and nesting habitat for birds. Many animals visit and live in riparian areas. They come for water, food, cover, and temperature moderation. Riparian areas often provide sheltered upstream and downstream transportation corridors to other habitats. Fish depend upon healthy riparian areas to provide stable channels, sustained water supply, clean and cool water, food, and streambank cover. Riparian areas are attractive and inviting to Forest visitors. People often seek water and riparian environments for recreation activities.

Management of riparian areas is considered in the context of the environment in which they are located, while recognizing their special values. Preferential consideration is given to riparian-dependent resources when conflicts among land-use activities occur. Riparian-dependent resources include fisheries, stream channel stability, water quality, and wildlife.

Wetland inventory

The U.S. Fish and Wildlife Service (USF&WS) has completed wetlands mapping for some of the State of Alaska, and all of the Chugach National Forest at a scale of 1:63,360. Original mapping was done from aerial photography with some ground-truthing. The wetlands were delineated and classified on the photographs using the USF&WS's hierarchical wetlands classification system. Wetland polygons from the photos were transferred to U.S. Geological Service (USGS) quad sheets, and subsequently digitized into a Geographic Information System (GIS) corporate database. The USF&WS's mapping designates approximately 1.28 million acres of the Forest as wetland. The acreage values displayed are undoubted lower than actual, since wetlands smaller than one acre were not generally mapped, and forested wetland areas were often not detected on the photography. Actual wetland acreages on the Forest may be higher by as much as 10-15 percent.

Table 3-7 gives a breakdown of the mapped wetlands on the Forest by system type. Estuarine wetlands are generally those in the intertidal zone that have a brackish (part salt water, part fresh water) component. Riverine wetlands include wetlands found within fresh water river channels. Lacustrine wetlands are defined as those wetlands and deepwater habitats within lakes deeper than about 6.5 feet, and larger than 20 acres in size. Palustrine wetlands are generally upland marshes, bogs, muskegs, and fens, and forested wetlands.

Not displayed on this table are 2,219,497 acres of subtidal and deepwater estuarine and marine wetlands. The Forest Service does not generally manage these wetlands.

Table 3-7: Wetland acres.[1]	
Wetland System	**Acreage**
Marine	20,715
Estuarine	258,259
Riverine	158,404
Lacustrine	94,447
Palustrine	750,645
Total	**1,282,470**

[1] The National Wetlands Inventory includes deep water and the fiords of Prince William Sound, which is not normally included in land managed by the Chugach National Forest.

Environmental Consequences

General Effects

Management impacts on surface water

Timber harvest and other vegetation management can and does increase water yield in many locations in the western United States. On the Chugach, increased water yields from vegetation management are slight due to low evapo-transpiration rates, high percentages of most watersheds lying within alpine areas, higher precipitation loading in alpine areas, and rapid resurgence of water-using understory vegetation when the forest canopy is removed. Water yield increases from road runoff, timber harvest, wildland fires, prescribed fires, and bark beetle infestations are generally too small to be detected through routine stream monitoring. Most Forest streams have very limited water appropriations, and all flow directly to the Pacific Ocean. Increases in runoff from vegetation manipulation are generally not in demand by downstream water users.

Soil and water improvements are accomplished on an annual basis to correct problems caused by previous land management. Corrective measures include, but are not limited to, closing, obliterating, and revegetating roads; redesigning drainage structures on existing roads to reduce soil loss and stream sedimentation; stabilizing damaged streambank segments using vegetation and/or structural support; and improving the vegetative condition of streamside riparian zones. Alternative A would average about 50 acres of watershed improvement projects a year. The No Action Alternative, and Alternatives B and C would average about 40. The Preferred Alternative and Alternative D averages 30 acres per year, and Alternatives E and F, 20 acres.

Management impacts to riparian areas

Previous management activities have impacted riparian areas throughout the Forest. Water diversion projects for hydropower development have affected the amount and the timing of flows in a stream channel, which can change the natural riparian community. Historic placer mining has in some cases dramatically impacted riparian vegetation and channel form. Access roads and intensive recreation pressure from fishing, camping, and boating have also had damaging impacts to localized riparian areas.

Recreation facilities have traditionally been developed adjacent to lakes and streams. Recreation use can result in localized impacts to riparian vegetation. Riparian vegetation usually becomes adversely impacted by a combination of trampling and soil compaction, reducing the viability and rooting capacity of these riparian plants. Destruction of this riparian vegetation can reduce streambank stability and increase streambank erosion.

Logging and its related activities can also affect the extent, health and vigor of riparian vegetation. Timber sales on the Kenai Peninsula over the last two decades have generally avoided timber harvest within riparian zones. Older timber sales in Prince William Sound (1960s and 1970s) sometimes harvested timber right up the edge of local anadromous streams. Road and trail construction adjacent to streams can physically remove the riparian vegetation, especially if roads and trails cross or run parallel to stream channels.

Placer mining on the Forest is generally located within riparian areas. Placer mining activity can involve removing the riparian vegetation, and processing the gravel substrates found within these riparian areas. Past placer mining practices on the Forest have led to introduction of heavy sediment loads into the stream channels, and, in some cases, alteration of the stream channel and flood plain system. Streams on the Forest particularly affected by past placer mining activities include Resurrection Creek and its tributary Palmer Creek, Bear Creek, Sixmile Creek, Mills, Juneau and Canyon Creeks, Cooper Creek, Bertha Creek, Lynx Creek, Silvertip Creek, Gulch Creek, Quartz Creek, and Falls Creek (near Crown Point).

Oil and gas development has the potential to adversely affect water quality and overall stream health by adding sediment an/or toxic substances from road and drill pad construction and drilling activities. Potential exists for spills of drilling fluids and oil and gas products entering surface and ground waters. Oil and gas operations are prohibited in areas subject to mass soil movement, riparian areas, and wetlands. Based on this, the effects of oil and gas operations on riparian areas would be mitigated for all alternatives.

The health and vigor of Forest riparian vegetation is generally good. The spruce bark beetle infestation on the western portion of the Forest is currently reducing streamside spruce cover, especially in mature, primarily Lutz and white spruce stands. In the short-term this is increasing the large woody debris supply on sections of some streams, and in the long-term, the supply may be diminish below normal.

Direct and Indirect Effects

Surface water, groundwater, riparian, and wetlands areas are interconnected and inter-related. In this section, they are dealt with together unless specifically noted. Potential adverse effects to watersheds, riparian and wetlands are directly tied to activities that impact and disrupt these areas. Impacting activities include disruptions to soils and vegetation, particularly when occurring close to stream channels, and disruption of surface and/or subsurface water flow.

Table 3-8, displays those activities that would affect water resources by alternative.

Table 3-8: Potential disturbances affecting water resources.

Activity	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Total recreation visits – millions of visits/year	10.15	10.15	10.15	10.15	10.15	10.15	10.15	10.15
Road construction – miles/year	6.7	3.3	11.4	10.0	2.9	2.2	1.6	1.3
Road construction – acres/year	11.8	6.2	20.0	16.7	5.4	4.2	3.0	2.5
Trail construction – miles/year	7.8	21.7	20.9	23.2	27.8	22.2	10.6	4
Trail construction – acres/year	3.7	10.4	10.0	11.1	13.3	10.7	5.1	1.9
Commercial timber harvest – acres/year	296	0	617	234	0	0	0	0
Firewood/hazard tree harvest – acres/year	625	375	913	770	426	355	260	235
Burned - acres/year	2,743	2,708	2,777	2,745	2,711	2,016	1,363	1,371
Campsites and cabins – acres/year	0.4	0.6	0.6	0.7	0.7	0.6	0.3	0.3
Mineral development – acres /year	20	20	20	20	20	20	20	20

Effects from Road Construction

As shown in Table 3-8, road construction (timber, recreation, and other roads) ranges from 1.3 miles per year under Alternative F to 11.4 miles under Alternative A. This would affect from 2.5 acres/year for Alternative F to 20 acres/year for Alternative A.

Potential adverse effects to water resources as a result of road construction and reconstruction are not exclusively dependent on miles or acres. Proper location, design, construction, and maintenance of the roads can have an immense effect on reducing water quality impacts. To reduce these impacts BMPs will be used in all phases of road development and use. Only the acres of watershed disturbance due to roads can by analyzed. Alternatives A and B have the highest risk of adverse effects. Alternative A proposes more new miles of roads/year than Alternative B, but also proposes obliterating more miles of road/year, so that watershed risk factors for the two alternatives are quite similar. The No Action Alternative proposes just over half the new roads as Alternatives A and B. In descending order the Preferred Alternative, then Alternatives C, D, E, and F all have substantially less proposed road miles, and would have lower watershed risks.

Roads potentially could have an impact to the riparian/wetlands areas. Location of the road within the riparian zone is the primary concern. Inappropriate width filter strips or improper drainage between the road and stream can produce additional sediment loading. Sidecast construction, poor quality surface aggregate or improper road maintenance can result in damage to riparian vegetation as well as increasing stream sediment loads.

Effects from Trail Construction

As shown in Table 3.8, trail construction varies from 4.0 miles per year under Alternative F to 27.8 miles per year under Alternative C. This would affect from 2.4 acres/year for Alternative F to 10 acres/year for Alternative C. Proper location, design, construction, and maintenance of the trails can have an immense effect on reducing water quality impacts. BMPs will be used in all

phases of trail construction and maintenance. Trails potentially could have an impact to the riparian/wetlands areas. Location of trails within the riparian zone should be avoided where possible. Appropriate width filter strips and proper drainage can reduce sediment loading.

Effects from Timber Harvest

Variations in timber harvest by alternative are displayed in Table 3.8. Timber harvest includes both commercial harvest and firewood/hazard tree harvest. Timber harvest level ranges from 235 acres to 1,530 acres per year.

All alternatives would allow harvest of some acreage for firewood and hazard tree removal. Only Alternatives A, B and the No Action Alternative include scheduled commercial timber harvest. These three alternatives all propose commercial timber harvest in just four watershed associations (of 95 on the Forest), Snow River (Kenai Peninsula), Montague Outside (Prince William Sound), McKinley Lake (Copper River Delta), and Martin River Northwest (Copper River Delta). Harvest techniques and timber sale locations would not vary significantly among alternatives.

Because of similarities of how and where commercial timber sales would be located in Alternatives A, B, and No Action, acres of harvest and miles of roads become an effective tool for comparing watershed impacts among alternatives. Alternative A would allow nearly twice the acreage of commercial timber harvest and miles of road as does the next closest alternative, the No Action Alternative. Alternative B would have just over a third of the acres of commercial harvest and miles of timber roads as Alternative A.

Firewood/hazard tree sales are all proposed within a mile of existing road systems and would generally treat any given acre lightly, that is, most of the timber would be left standing. Watershed impacts would relate primarily to water concentration/erosion along skid trails. Watershed impacts from firewood sales would be substantially less than for commercial timber sales on an acre-to-acre basis. Acres of firewood/hazard tree sales can be used qualitatively to compare effects among alternatives. Alternative A would have the largest effect. Alternative B has about 85 percent of this acreage and effect; the No Action Alternative about 70 percent; Alternative C, 45 percent; the Preferred Alternative and Alternative D, 40 percent; Alternative E, 30 percent; and Alternative F, 25 percent.

Overall for personal and commercial timber harvest, Alternative A would be expected to have the most substantial impacts to water resources. Alternatives B and No Action would come next and be similar to one another; about half of Alternative A. Alternative C, the Preferred Alternative, and Alternatives D, E, and F would have successively less impacts, and a relatively small fraction of Alternative A.

Primary watershed impacts from Forest timber sales generally come from the diversion and concentration of natural runoff along roads, landings, and skid routes. Diversion and concentration of runoff can, in some instances, lead to soil erosion, and sediment supply to nearby streams, which can in turn adversely

impact stream habitats. On steeper slopes, water diversion can occasionally supersaturate soils and cause slope failures, resulting in loss of long-term soil productivity through altered wetness, and large transported sediment loads.

Using acres of timber harvest to compare alternatives helps give a feel for the effects to water resources. Forest Plan alternatives indicate acres of harvest by watershed association, but are not specific about location of harvest units or roads. Actual location of the sale units, and the roads and skid trails within them, as well as the timing of the harvesting, are more useful in predicting actual impacts to water. To reduce impacts, road and sale location and timing can be controlled substantially using BMPs during sale planning and implementation.

Some timber sales around the United States have shown increased water yields and compacted soils as watershed effects of the harvest. Increased water yields from timber harvest on the Chugach are generally negligible due to low evapo-transpiration rates, vigorous understory vegetation, and the high percentage of most watersheds above timberline. Soil compaction on the Chugach mostly occurs along major skid routes, and appears not to impact regrowth, but can on occasion intensify drainage diversion and erosion rates along the route.

Effects from Fires

The Forest averages about 15 wildland fires per year. This would continue under all alternatives. The wildland fires are mostly on the Kenai Peninsula portion of the Forest where precipitation is moderate. Other parts of the Forest generally have high enough precipitation levels as to make any burning quite rare.

Prescribed burning is used to reduce fuel hazards, dispose of timber slash, and improve wildlife habitat. The No Action Alternative, the Preferred Alternative, and Alternatives A, B, C, and the No Action Alternative all propose burning a similar number of acres and should have similar watershed effects. Alternatives E and F propose burning about half the amount as the others, and Alternative D, about three quarters as much. Most prescribed burning would be done on the Kenai Peninsula. Prescribed fires on the Forest generally burn at lower temperatures and have less damaging watershed effects than wildland fires. Prescribed burns would reduce the risk for occurrence of very hot wildland fires in the future. In this sense, prescribed fires actually work to reduce watershed damage risks to the Forest over the long term.

In certain instances, fires, particularly very hot wildland fires, could affect water quality, primarily through increased sedimentation. The effects of this sediment in the drainage system will be dependent upon the composition of channel types (see Aquatic Ecosystems and Essential Fish Habitat section in this chapter) within the watershed. Watersheds with high gradient channels will tend to flush the sediment out whereas watersheds with a high percentage of low gradient channels will retain the sediment longer. Channels generally will see a reduction in sediment within the first three years.

Hot fires can eliminate the erosion protection afforded by vegetation and soil organics. This can cause increases in erosion and sediment transport caused by rainfall and sheet erosion. In some instances a hydrophobic soils layer is created

that can greatly increase erosion and erosion effects. Fires on the Chugach National Forest generally do not burn at hot, soil damaging temperatures. Even the largest wildland fires are generally patchy in character, leave some organic soil, and do not create hydrophobic soils. Natural regrowth of forbs and other understory vegetation generally occurs rapidly, often with good coverage in place the following year. No severe erosion effects from either wildland fires or prescribed burns have been recorded on the Forest over the last 30 years.

Effects from Recreation Management

Many camping sites, both dispersed and developed, are near lakes, reservoirs, wetlands, and streams. Although these are desirable locations, repeated use can reduce the health and vigor of riparian vegetation and compact soils, both of which can reduce the riparian vegetation's ability to maintain streambank stability and increase sedimentation. Soil compaction is caused by the weight of vehicles, animals, and people on the ground. Soil compaction impairs infiltration and plant growth. It is generally more severe on moist or clay-rich soils and with more traffic.

Disturbing soil and concentrating runoff can cause erosion and sedimentation. Excess sediment impairs aquatic habitat. Stream sedimentation is usually more severe when disturbances occur near streams or on unstable or highly erodible soils.

The use of riparian areas by developed and especially dispersed recreation has a potential for impacts. Popular riparian areas receive intensive use for camping, fishing and hiking. Impacts may range from vegetation reduction, soil compaction and streambank trampling from overuse. Specific problems are identified and managed during project level analyses. Solutions may range from closing the area to revegetation or hardening of the site. Stream bank damage is caused by foot and wheeled traffic. Overhanging banks can be crushed and large amounts of sediment added directly to streams, with resulting damage to aquatic habitat. Bank damage is more severe where animals and people concentrate along streams.

Wetland-riparian damage occurs mostly as ruts and puddles caused by foot and wheeled traffic. Surface and subsurface drainage is changed and plant growth may be impaired.

In general, these effects are low except at points of concentrated use. Specific problems are identified and managed at project level analysis. Proper management, use of BMPs and standards and guidelines will reduce potential impacts to the water resource.

Projected recreation visits do not vary by alternative.

Effects from Snowmobiles

Adverse effects from snowmobiles are generally limited to areas of concentrated use such as on unplowed roads near access areas. When conditions are right, compacted snow can remain on roads and act as a barrier to spring runoff, which can cause erosion. Snowmobiles can also cause vegetative damage, soil

compaction, and damage to wetlands when they are operated in thin snowpacks. The degree of potential erosion is dependent on site-specific factors such as slope, aspect, elevation, adjacent vegetation, level of use, and weather conditions.

Discharge from two-stroke snowmobile engines can lead to indirect pollutant deposition into the top layer of snow and subsequently into the associated surface and ground water (Adams 1975). Hagemann and Van Mouweik (1999) found that there is a potential risk to aquatic life from snowmobile emissions but that the risk could not be quantified because of a current lack of water quality data. Adams (1975) showed that high concentrations of lead and hydrocarbons were found in pond water adjacent to snowmobile trails during the weeks following ice melt. The study also found that juvenile brook trout had increased hydrocarbon intake and reduced stamina, from surface water and food chain feeding and hydrocarbon uptake.

Some of the unburned hydrocarbons would accumulate on the snow surface and eventually wash into streams and lakes. This could cause localized degradation of the high water quality of the waters of the Chugach National Forest. Concentrated snowmobile use areas, primarily around Turnagain Pass where the potential impact to water quality exists. Turnagain Pass has the highest use concentrations on the Forest (Skustad 2001). Maximum use counts indicated a peak of 100 vehicles per day associated with snowmobile users. Generally, use was less than 50 vehicles on weekend days. Weekday numbers averaged around 10. The area around Upper Granite Creek would be the area most prone to accumulations of hydrocarbons. The aquatic ecological communities do not appear threatened by these concentrations, and this diminishment to water quality would be below the federal standards for pollution, but additional monitoring is needed to establish that standards are not being exceeded.

Effects from Dams and Water Diversions

Dams and water diversions can change channel dimensions, alter aquatic and riparian habitat, and obstruct fish migration in streams. When they occur, these impacts can be both local (directly below the reservoir or diversion) and far reaching. Such projects can cause downstream dewatering with adverse effects to aquatic species. Future permits and licenses are required to be consistent with the Forest Plan. As permits are amended, renewed, or issued, the Forest will analyze environmental effects and ascertain if additional mitigation or new terms and conditions are required for the permit to meet the Revised Forest Plan standards and guidelines.

Beneficial use of water in the form of water diversions from existing streams would not vary by alternative. Potential adverse effects of future uses would increase with each water rights application. These effects are common to all alternatives.

Effects from Mining Operations

Current mining occurring on the Forest is limited primarily to small-scale placer mining operations for gold, and a few gravel pits and rock quarries. The placer

gold operations mostly use small suction dredges that work instream to separate gold from stream gravels. These operations can cause some alteration of substrates within the stream channel. Gold operations working outside stream channels are required to use settling ponds for process waters, and to rehabilitate and revegetate mined areas on completion of mining. Historic placer operations on the Forest have caused large-scale disturbance of several streams and their associated floodplains. Disturbance and stream sedimentation effects of current operations are small in comparison. The Forest Service currently requires use of minerals BMPs for mining operations on the Forest. Gravel and rock extraction operations will use BMPs and are generally situated away from streams and riparian areas so as to have minimal effects on water quality or aquatic habitats. Several past gravel operations have in fact been used in creating ponds for fisheries enhancement.

Numbers of mining operations do not vary by alternatives, and basically the same level of mining would be expected under all alternatives.

Cumulative Effects

Potential cumulative effects on water resources resulting from past, current, and future management are based on the total amount of disturbance. Past management activities have been concentrated within certain watersheds. These are the watersheds where most activities under any of the alternative would continue. Most watershed associations on the Forest are virtually untouched by roads or large-scale management activities, and retain pristine watershed characteristics (see Affected Environment, this section). Reductions in connected disturbed area resulting from soil and water improvements could reduce the potential for adverse cumulative effects.

With increases in recreation users Forestwide, potential impacts to streams, riparian vegetation and overall watershed potential could increase. Riparian settings receive protection under all alternatives through the application of the Forestwide standards and guidelines and BMPs. The possibility for damage to the riparian system is greater in those alternatives with more activities such as road building. Nevertheless, identification and protection of riparian areas during project planning and monitoring prevent widespread or long-term deterioration of riparian resources.

Potential cumulative effects as a result of water put to beneficial use through diversions of surface water would depend on future water rights applicants. Substantial diversions from Forest streams at this time occur for two hydroelectric power projects and several fish hatcheries. Some adverse impacts to native aquatic species and their habitat have occurred at these sites, and additional diversions would generally increase these effects.

Of the alternatives analyzed, implementation of Alternative A has the highest risk of adverse cumulative effects to the water resource. Alternative B, the No Action Alternative, Alternative C, the Preferred Alternative, and Alternatives D, E and F each follow with successively less impacts. The use of Forestwide standards and guidelines and BMPs will reduce the potential for adverse cumulative effects.

A consumptive water use that has not been tested on the Forest but may be of interest in the future is the ocean transport of domestic (drinking) water to cities on the Pacific Rim. Several companies have tested transporting water in ocean-going tankers or even towing in large barges. As good quality drinking water becomes more difficult and expensive to obtain locally in some coastal cities, Alaska's abundant coastal waters may become of increasing interest. Undertaking large-scale marine transport of Forest water in the next 10 to 15 years appears unlikely, but is worthy of note and consideration. Depending on where water was taken from, and how much, water withdrawals could adversely impact some aquatic species.

Biological Elements

Biodiversity

Aquatic Ecosystems and Essential Fish Habitat

Fire Management

Insects and Diseases

Forested Vegetation

Plants

Wildlife

Biodiversity

Introduction

Biodiversity includes the ecosystems, plant and animal communities, species, genes, and processes through which individual organisms interact with one another and with their environment. Natural disturbance processes and human influences both affect the biodiversity of an area. Human induced changes in landscape pattern can be assessed by comparing ecological conditions that existed prior to modern human settlement of the area to current conditions. Most species of plants and animals on the Chugach National Forest are protected by using a coarse filter strategy (entire ecosystems and landscapes) of maintaining the components of vegetation composition and structure that are essential to their habitat needs. Rare species with narrow ecological amplitudes requiring specific habitat conditions are managed through a fine filter strategy (individual species and their habitats). Potential impacts to fragmentation, perforation, late successional and old growth forests, and landscape patterns characteristic of forested cover types are specifically assessed.

The conservation of biological diversity or "biodiversity" is of national and global concern. Biodiversity may be defined as "the full variety of the life in an area, including the ecosystems, plant and animal communities, species, and genes, and processes through which individual organisms interact with one another and their environments" (USDA Forest Service 1992b).

Biodiversity combines the physical environment with the biological environment. Both are influenced by, and in turn influence, the human environment. The physical environment consists of soils, water, and air. The biological environment is the pool of available species that successfully compete for existence in an area. This includes the full complement of living organisms - from inconspicuous soil bacteria and fungi to the more visible vascular plants and animals.

Biodiversity is understood in terms of the natural and historic numbers and distributions of plants and animals, habitats, and communities. To evaluate the biodiversity of the Chugach, it is necessary to examine this variability over time. Over these long periods, plants and animals have fluctuated with changes in climate. Their number and distribution have changed because of the species interactions, migrations into and out of the region, and other factors.

Natural processes. One way to promote biodiversity is to accept, where appropriate, the outcomes such natural processes as fire, windstorms and insect infestations. Many plants and animals evolved in response to such disturbances are suited to live in an environment in which they occur. For instance, wildfire has played a role in the origin of the mixed conifer and hardwood stands on the Kenai Peninsula (Potkin 1997). Insects and diseases, and the conditions that favor them, further shape the structure and composition of the spruce and mixed spruce forest communities on the Kenai Peninsula.

Human influences. Human influences also play a role. Some species, such as the Sitka black-tailed deer, mink, and noxious weeds, have been intentionally (or unintentionally) introduced to the Forest while others, such as the Kachemak gray wolf, have been extirpated. Humans have also had a profound effect on disturbance regimes particularly on the Kenai Peninsula.

Variability. Biodiversity is never stable through time; it fluctuates in response to ever-changing human and environmental influences. Some of the Forest exists in the same conditions that were present in the area before large-scale human development began. The Kenai Peninsula and Copper River Delta are currently undergoing responses to large-scale environmental conditions that have changed vegetation succession patterns or stand conditions. On the Kenai the changes are in response to a spruce beetle (*Dendroctonus rufipennis* Kirby) infestation that has affected over 40 percent of the forests since the late 1950s (DeLapp et al. 2000). Vegetation on the Copper River Delta is undergoing extensive succession in response to the 1964 earthquake, which uplifted the area between 6 and 11 feet (DeVelice et al. 1999b).

Scales of biodiversity. Biodiversity occurs at the following four scales (Noss 1990):

- **Genetic diversity** - the genetic variation within and among individuals and populations of the species that influences such things as adaptability and resistance to stress.
- **Species diversity** - the variety of different species found in an area. Some species are commonplace; others have small, reduced, or even threatened populations.
- **Community or ecosystem diversity** - the association of different species and their interactions with one another and physical environment.
- **Landscape or regional diversity** - the variety of communities or ecosystems over a larger area.

Conservation of biological diversity requires a dual strategy that addresses both the habitat needs of individual species and entire ecosystems (course filter analysis). The traditional species-by-species approach is important for management indicator species, sensitive species, and other species of special concern (fine filter analysis).

In this analysis, biodiversity is described in terms of:

1. Ecoregions;
2. Habitat Diversity;
3. Expected Range of Variability; and,
4. Wildlife – Coarse Filter.

Legal and Administrative Framework

- The **National Forest Management Act of 1976 (NFMA)** states that the forest plan must "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area."
- **Ecosystem Management** In 1992, the Chief of the Forest Service issued a statement committing the Forest Service to the practice of ecosystem management, which is an ecological approach to managing national forest and grasslands for multiple purposes.
- **The Endangered Species Act of 1973** governs the protection of listed species and the ecosystems upon which they depend.
- The **Forest Service Manual (2672)** requires the Regional Forester to identify sensitive species occurring within the region.
- The **Forest Service Manual (2672.4)** requires that a biological evaluation (BE) be prepared for all Forest Service activities to address impacts to Forest Service sensitive species.
- **36 CFR 219.27 (g)** states that management prescriptions, when appropriate and to the extent practicable, shall preserve and enhance the diversity of plant and animal communities.
- **36 CFR 219.19** requires the Forest Service to identify and prevent the destruction or adverse modification of habitat determined to be critical for threatened and endangered species. It states that fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species. Viable populations are defined as those with sufficient numbers and distribution of reproductive individuals to ensure their continued existence in the planning area.

Key Indicators

- Changes in the regional landscape
- Changes in land cover, vegetation and forest structure
- Bioenvironmental classes (generalized climate, vegetation, and landforms)
- Wildlife species richness by prescription category
- Wildlife species richness by land cover class and habitats of special interest

Resource Protection Measures

Ecosystem processes influence plant productivity, soil fertility, water quality, and many other environmental conditions affecting the health of the Chugach

National Forest. These processes are controlled by the diversity of plant and animal species present on the Forest.

Much of the Chugach National Forest remains largely unaltered by direct human activities. The Kenai Peninsula is where the bulk of historic large-scale changes in vegetation have occurred in response to human activities (including mining, logging, land clearing, and fire disturbances). Natural and human-caused events may diminish the natural diversity of plant and animal species and habitats. When conditions are outside of the range of natural variability, management action (or inaction) may be necessary in order to restore healthy ecosystem processes.

NFMA regulations require that viable and well-distributed populations of all native (and desirable non-native) resident species be maintained across the national forest. All management activities on national forest lands are evaluated in order to satisfy these regulations.

Affected Environment

Introduction

A regional landscape approach was used to assess how well various alternatives will allow the Forest to meet the following goals:

> "Maintain the abundance and distribution of habitats necessary to support viable populations of existing native and desired non-native species."
>
> "Maintain habitat to produce sustainable wildlife populations that support the use of fish and wildlife resources for hunting, fishing, subsistence, and other values."
>
> "Emphasize maintenance of fish and wildlife habitat in 501(b) area of the Chugach National Forest."

Biological diversity encompasses the variety of genetic stocks, plant and animal species and subspecies, ecosystems, and the ecological processes through which individual organisms interact with one another and their environments. The National Forest Management Act (NFMA) requires consideration of biological diversity for the area covered by each forest plan.

Biological diversity is defined and understood in terms of the natural and historical numbers and distributions of plants and animals, habitats and communities. For instance, in an old-growth forest ecosystem, much of the biodiversity is found within stands of old growth: variations in tree heights and species, differences in understory species, the presence of small openings within a stand, etc. This is the natural habitat for many of the animals living there, and defines the biological diversity important for their survival. Creating a greater amount of younger aged stands of trees may increase the absolute diversity of tree stands, but it may reduce the natural diversity of the ecosystem by creating more young stands than naturally or historically occur. It also reduces the

amount of diverse, usable habitats for the species conditioned to old-growth forests and the biological diversity inherent in old growth.

The conservation of biological diversity commonly requires a dual strategy addressing both individual species as well as entire ecosystems (Marcot et al. 1994). The traditional species-by-species approach is important for featured or management indicator species, sensitive or rare species, and for recovery of federally designated threatened or endangered species. Additionally and perhaps more important, a more comprehensive strategy focused on higher levels of biological organization and ecosystems may be necessary to conserve rare or declining habitats such as old-growth forests, plant and animal communities and ecosystems, as well as the entire complement of associated biota and ecological processes (Noss 1991, Scott et al. 1991, Franklin 1992).

Through this approach, the following basic principles as described by Concannon and others (1999) were considered:

1. Minimizing the fragmentation of habitats across the landscape;
2. Conserving large blocks of habitat at the regional landscape scale;
3. Conserving blocks of habitat close together and in contiguous blocks;
4. Maintaining corridors between large blocks of habitat; and,
5. Maintaining favorable habitat conditions for target species across their native range.

The regional landscape approach allows us to put the Chugach National Forest into perspective when considering the range of natural communities (Noss 1990) and species and community diversity on the landscape. Using a landscape approach also makes it possible to identify ecological processes, such as natural disturbance regimes, hydrologic processes, nutrient cycles, and biotic interactions essential for maintaining the natural variability of the landscape or regional biodiversity (Austin and Margules 1986). This constitutes the "coarse filter" approach to biological conservation (Hunter 1991).

The net effect of using the landscape approach in the coarse filter analysis allows us to evaluate how well the communities, structure, and processes of various landscapes are to be managed under different alternatives. How each alternative considers every kind of habitat, community, or ecosystem in terms of management protection was determined using a landscape analysis approach. The protection status provided to these ecosystems will be determined by considering the category of each land management prescription to the protection status levels of Duffy and others (1999) and how they are applied on the landscape.

The coarse filter approach to forest management is a strategy for maintaining the viability of most species present on the Chugach by maintaining the components

of ecosystem composition and structure that are believed to be essential to their habitat needs. The underlying concept is that a representative array of vegetation cover types will include the appropriate vegetation mosaics that will accommodate most species. The discussions concerning coarse filter are found in the following sections. For this coarse filter assessment, the location and distribution of species and ecosystems diversity at the Ecoregion, Forest, and within the Forest scales are considered.

For the Chugach National Forest, habitat needs for sustaining viable populations of individual species are addressed first by the coarse filter land allocation approach, and then by guidelines judged necessary for specific species or groups of species using the fine filter. Habitat distribution for well-distributed populations will be provided at several scales. Timber harvest is projected within four of ninety-five watershed associations. All alternatives will provide large blocks of habitat that would remain intact and essentially unmodified at the watershed association and geographic area scale.

The forest types most affected by resource management of the Chugach are the old-growth structural stages of the needleleaf and mixed needleleaf/broadleaf forests. The biological diversity associated with these forests is only beginning to be recognized and described. For instance, Franklin (1992) estimated that invertebrate biota, creatures essential to ecosystem function through such processes as nitrogen fixation and decomposition, might represent over 90 percent of the species diversity of old-growth forests in the Pacific Northwest. The most conceivable way to address conservation of these and other elements of biodiversity is by using an ecosystem- or landscape-based strategy (see also Noss 1991).

Table 3-9: Biodiversity components and scales.

Component	Scale[1]
Composition	Landscape Types
	Communities
	Ecosystems
	Species
	Population
Structure	Landscape Patterns
	Habitats
	Genetic
Function	Landscape Processes and Disturbances
	Land Use Trends
	Interspecific Actions
	Life Histories

[1] Based on Noss

For the effects analysis presented later, it will be assumed that if functional and inter-connected ecosystems are maintained across the Forest, then the closely associated components and ecological processes will also be maintained.

Biological diversity within any ecosystem, from a regionally-defined ecosystem such as the Pacific Coastal Mountains Forest-Meadow Province down to a watershed, riparian area, or individual stand of trees, can be described in terms

of three components: composition, structure, and function. Composition refers to the numbers and types of species, plant communities, and smaller ecosystems within an area. Structure refers to the arrangement of these communities or ecosystems across a landscape, and how they are connected, to variations in tree heights and diameters within a stand or between stands, etc. Function refers to the interactions and influences between plant and animal species within an area - how each species uses its environment - and to natural processes of change or disturbance (wind, aging, etc.). Table 3-9 lists these components and some scales at which they can be described.

Ecoregions of the Chugach

The national hierarchical framework of ecological units provides a system for delineating ecoregions (ECOMAP 1993). Ecological units within the broader levels of the ECOMAP hierarchy include province and section. At the province level, the Forest resides within the Pacific Gulf Coastal Forest-Meadow and Pacific Coastal Mountains Forest-Meadow provinces (Bailey 1995). The section level includes the Alaska Mountains, Kenai Mountains, Chugach Mountains, St. Elias Mountains, Northern Gulf of Alaska Fiordlands, and the Northern Gulf Forelands sections (Davidson 1996). For the purposes of this Environmental Impact Statement an intermediate class between province and section was also developed called Ecological Region (Table 3-10).

Pacific Gulf Coastal Forest-Meadow Province

Lush, lichen-draped temperate rain forests of hemlock and spruce interspersed with open wetlands blanket the shorelines and adjacent mountain slopes along the Gulf of Alaska. A cool, hypermaritime climate dominates with minor seasonal temperature variation and extended periods of overcast clouds, fog, and precipitation. Snow is abundant in the winter and persists for long periods at sea level. Permafrost is absent. Tectonic events have raised and submerged various portions of the coastline over time. Common forest animals include black and brown bear and Sitka black-tailed deer. Bald eagles, common murres, Bonaparte's gulls, Steller sea lions, harbor seals, and sea otters teem along its endless shorelines. Numerous streams and rivers support Dolly Varden char, steelhead trout, and all five species of Pacific salmon. Salmon spawning runs deliver tremendous amounts of nutrients to aquatic and terrestrial systems. A fiordal coastline and archipelago exists around Prince William Sound and points west where continental ice sheets repeatedly descended in the past. Here, fjords formed where glacier-carved terrain filled with seawater after deglaciation. At the head of fjords lie broad U-shaped valleys that have steep, deeply incised sidewalls draped with hanging glacial valleys. A coastal foreland extends from the Copper River Delta southeast to Icy Point fringed by the slopes and glacier margins of the Chugach-St. Elias Mountains. Here, unconsolidated glacial, alluvial, and marine deposits have been uplifted by tectonics and isostatic rebound to form this relatively flat plain. Because of its geographic position, the foreland is water-drenched through persistent maritime precipitation and overland runoff from the mountains. The organic soils shed water slowly and are blanketed with wetlands among meandering and braided silt-laden streams.

Temperate rain forests of hemlock and spruce occur sporadically where soil drainage affords (e.g., moraines, stream levees, uplifted beach ridges). Rare dusky Canada geese and trumpeter swans nest on these wet flats where brown bear, Sitka black-tailed deer, and moose roam.

The Pacific Gulf Coastal Forest-Meadow Province has been recognized, as being globally important because approximately 25 percent of the world's coastal temperate rainforests occur here. According to Ricketts and others (1999; Key Number 23) this area is approximately 85 percent intact, (intact habitat being "relatively undisturbed areas that are characterized by the maintenance of most original ecological processes and by communities with most of their original suite of species"). Within this province, species richness (conifers, plant associations, birds, mammals) declines with increasing latitude (DeMeo et al. 1993). The Chugach is at the northern end of the province.

Old-growth forests within this province, in particular, are important fish and wildlife habitat, due to the unique structural attributes (multilayered canopies, diverse forb and shrub layers, coarse woody debris, large diameter trees, etc.) (Ricketts et al. 1999). These attributes begin to appear when a forest reaches 150 years, although this may vary by plant association (Capp et al. 1992).

Many species that are threatened in the lower forty-eight states are present in far greater numbers in this province (Ricketts et al. 1999) Some of the highest concentrations of bald eagles and marbled murrelets in North America occur in southeast Alaska, Prince William Sound, and the Kodiak Archipelago (Ricketts et al. 1999). Within this province is the Copper River Delta wetland complex, one of the largest contiguous wetlands found on the Pacific coast of North America (DeVelice et al. 1999a). The Copper River Delta is recognized as a rich waterfowl and shorebird breeding and migration area.

This province is considered to be Class III "Globally or regionally outstanding" that presents a rare opportunity to conserve large blocks of intact habitat. This province contains globally or regionally high levels of biodiversity or rare ecological processes (Ricketts et al. 1999).

Pacific Coastal Mountains Forest-Meadow Province

Arcing terranes of Pacific origin have been thrusted onto the North American continent forming a rugged ice-clad mountain chain that surrounds the Gulf of Alaska. This is the largest collection of ice fields and glaciers found on the globe outside the polar region. These towering mountains of faulted and folded sedimentary rocks intercept an abundance of maritime moisture, mainly in the form of snow. Huge ice fields, snowfields and glaciers form a continuous matrix over these mountains interrupted occasionally by rock cliffs and small exposed peaks called "nunataks." In the summer, melt water accumulates atop the ice fields and glaciers forming rivulets that eventually plunge down vertical ice shafts called moulins. Where they exude onto coastal flats, glaciers spread to form expansive lobes that gush water at their edges. Some glaciers run all the way to tidewater. Ice sheets swelled during past glaciations, inundating surrounding lands along the coast as well as the Interior. The sheer height of these

mountains together with their expansive ice fields forms an effective barrier for Interior species except along the Alsek and Copper River corridors. Thin and rocky soils exist where mountain summits and slopes are devoid of ice, snow, and active scree. Here, alpine communities of sedges, grasses, and low shrubs grow which, in turn, support Dall sheep, mountain goats, hoary marmots, pikas, and ptarmigans. Broad U-shaped valleys, many with sinuous lakes, occur where glaciers and ice fields have pulled back sufficiently. Here, deeper soils have formed in unconsolidated morainal and fluvial deposits underlain by isolated pockets of permafrost. Alder shrublands and mixed forests occur on lower slopes and valley floors where moose and brown and black bears forage.

The Pacific Coastal Mountains Forest-Meadow Province has been characterized as "Bioregionally outstanding" for its biological distinctiveness (Ricketts et al. 1999; Ken Number 104). The ecosystems of this province remain generally intact, with their full range of top predators existing in their natural ranges of variation. The portion on the Kenai Peninsula holds particular biological interest as a mixing area of populations from the forests of both sides, specifically between the Snow River drainage on the west side to King's Bay in Prince William Sound. Additionally, major rivers that bisect this province, including the Copper, provide migratory corridors for waterfowl, passerines, and terrestrial mammals that connect the coastal forests with interior areas. In addition, salmon stocks in this province are of continental significance (Ricketts et al. 1999).

Except for the Kenai Mountains Section, this province has suffered little habitat loss, degradation, or fragmentation. The Kenai Mountains Section is where the bulk of historic large-scale changes in forest composition and structure have taken place on the National Forest (DeLapp et al. 2000). These changes have been due to activities since settlement by Europeans and include mining, logging, land clearing, and fire disturbances. In addition, over 40 percent of the forested area of the Chugach National Forest in the Kenai Mountains Section has been impacted by the spruce beetle since the late 1950s (DeLapp et al. 2000).

Table 3-10 shows the hierarchy of spatial units used in the biodiversity assessment.

Table 3-10: Hierarchy of spatial units used in the biodiversity assessment.

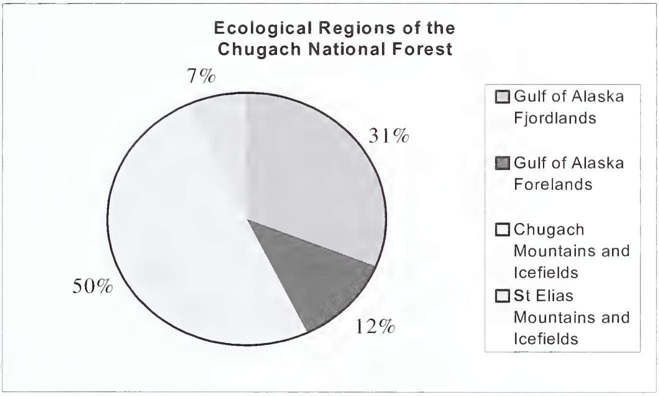
Province	Ecological Region	Ecological Section
Pacific Coastal Mountains Forest-Meadow	Chugach Mountains and Icefield	Alaska Mountain
	Chugach Mountains and Icefields	Kenai Mountain
	Chugach Mountains and Icefield	Chugach Mountain
	St. Elias Mountains and Icefields	St. Elias Mountain
Pacific Gulf Coastal Forest-Meadow	Gulf of Alaska Fiordlands	Northern Gulf of Alaska Fiordlands
	Gulf of Alaska Forelands	Northern Gulf Forelands

Within these general categories, the Chugach National Forest can be further divided into four general ecological regions (Figure 3-3a). Within the general ecological regions are listed the ecological sections of Davidson (1996) (Figure 3-3b).

The Chugach National Forest plays a unique role in providing habitat for a wide range of wildlife species. This diversity ranges from marine mammals and seabirds to neotropical migrants and mountain goats. The three distinct geographical areas on the forest, the Kenai Peninsula, Prince William Sound, and the Copper River Delta, all have integral roles in the ecosystem processes taking place in Southcentral Alaska. The 5.49-million-acre landscape is composed of glaciers and ice fields, major glacially-fed rivers and outwash plains, steep, rugged mountain sideslopes, rolling hills, temperate rainforests, and over 4,700 miles of shoreline.

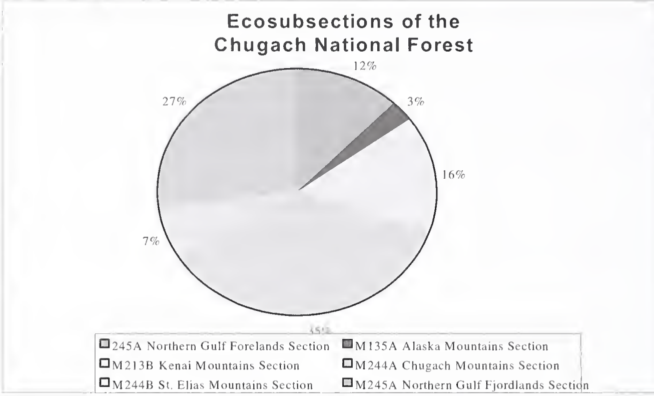
Wildlife species were evaluated to identify those species associated with the land cover types that occur within the forest (coarse filter) and were also evaluated to identify those most sensitive to reasonably foreseeable land management actions (fine filter).

Figure 3-3a: Ecological regions of the Chugach National Forest (CNF lands only).



Source: Chugach National Forest GIS corporate database.

Figure 3-3b: Ecological sections of the Chugach National Forest (CNF lands only).



Source: Chugach National Forest GIS corporate database.

Habitat Diversity

Land Cover

There is a wide range of forested and unforested habitats on the Chugach (DeVelice et al. 1999b; Boggs 1996, 2000), proportions of which vary by ecological region (Table 3-11). The Chugach and St. Elias Mountains and Icefields regions are dominated by ice, snow, and rock, with lower proportions of herbaceous alpine and subalpine vegetation. The Gulf of Alaska Fiordlands and Forelands are both dominated by closed needleleaf conifer forests and tall shrubs (primarily alder).

Table 3-11: Percent land cover classification of the Chugach National Forest by ecological regions.

Land Cover Class	Chugach Mountains	Gulf Fiordlands	Gulf Forelands	St Elias Mountains
Forest-Needleaf-Closed	4.23	30.08	22.15	1.27
Forest-Needleaf-Open	0.52	6.18	3.01	0.61
Forest-Needleaf-Woodland	0.98	5.20	0.00	0.00
Forest-Broadleaf-Closed	2.99	3.80	0.00	0.00
Forest-Broadleaf-Open	0.71	0.00	0.00	0.78
Forest-Mixed-Closed	0.23	0.04	0.00	0.00
Forest-Mixed-Open	0.08	0.04	0.00	0.00
Scrub-Dwarf Tree-Open	0.10	1.66	0.00	0.05
Scrub-Tall shrub-Closed	8.35	10.72	18.70	9.76
Scrub-Tall shrub-Open	1.75	0.77	1.87	0.17
Scrub-Low shrub-Closed	4.53	8.87	3.68	2.02
Scrub-Low shrub-Open	1.01	6.94	2.09	0.11
Herb-Graminoid/Forb-Dry/Mesic	6.74	6.12	12.90	3.71
Herb-Graminoid/Forb-Wet	0.24	3.04	10.60	1.73
Herb-Bryoid-Mosses	0.04	0.21	0.00	0.00
Herb-Bryoid-Lichens	1.02	0.00	0.00	0.00
Herb-Aquatic-Fresh	0.00	0.00	1.34	0.00
Herb-Aquatic-Brackish	0.00	0.03	0.21	0.00
Barren-Unconsolidated or Bedrock	11.10	5.02	4.44	20.00
Barren-Sand/Mud	0.43	1.60	10.72	0.22
Other-Ice/Snow/Clouds	52.74	9.56	6.10	59.14
Other-Sparsely Vegetated	2.21	0.11	2.19	0.42
Total	**100.00**	**100.00**	**100.00**	**100.00**

Source: Chugach National Forest GIS corporate and AK Department of Natural Resources databases.

The land cover classes can also be summarized by the geographic areas of the Chugach National Forest (Table 3-12). The Chugach National Forest is characterized as a land of ice and snow, needleleaf forest, and shrubs, with ice and snow making up almost 35 percent of the area. The Copper River Delta (CRD) is dominated by unforested and unvegetated cover classes, with shrubs and graminoids, the dominant vegetation classes. Forested cover types make up only 10 percent of the area. The Kenai Peninsula (KP) is characterized by alpine and subalpine conditions of ice, snow, barren, shrubs, and herbaceous vegetation classes, with almost 16 percent of the area covered by closed needleleaf and broadleaf forests. Prince William Sound (PWS) is characterized by the largest expanse of ice and snow, and the largest expanse of needleleaf forests, with almost 20 percent of the area supporting conifer stands.

Table 3-12: Percent land cover types of the Chugach National Forest by geographic area.

Land Cover Class	Copper River Delta	Kenai Peninsula	Prince William Sound	Total
Forest - needleleaf - closed	8.49	8.52	13.56	10.92
Forest - needleleaf - open	1.39	0.98	3.08	2.11
Forest - needleleaf - woodland	0.00	1.30	3.16	1.79
Forest - Broadleaf - Closed	0.00	7.24	1.72	2.37
Forest - Broadleaf - open	0.57	0.00	0.00	0.18
Forest - Mixed - Closed	0.00	0.52	0.01	0.12
Forest - Mixed - Open	0.00	0.21	0.02	0.06
Scrub - Dwarf Tree - Open	0.03	0.19	0.97	0.51
Scrub - Tall shrub - Closed	10.93	13.88	5.75	9.09
Scrub - Tall shrub - Open	0.73	4.36	0.43	1.36
Scrub - Low shrub - Closed	3.26	7.83	5.42	5.27
Scrub - Low shrub - Open	0.82	2.12	3.86	2.55
Herb - Graminoid / Forb - Dry/Mesic	6.80	12.61	4.08	6.74
Herb - Graminoid / Forb -Wet	4.63	0.06	1.73	2.27
Herb - Bryoid - Mosses	0.00	0.00	0.18	0.08
Herb - Bryoid - Lichens	0.00	2.58	0.00	0.55
Herb - Aquatic - Fresh	0.56	0.00	0.00	0.17
Herb - Aquatic - Brackish	0.08	0.00	0.01	0.03
Water - Salt - Clear	0.09	0.13	0.53	0.31
Water - Salt - Turbid	6.22	2.71	1.41	3.17
Barren - Unconsolidated or Bedrock	14.88	5.79	5.71	8.55
Barren - Sand / Mud	0.83	0.60	0.07	0.42
Other - Ice / Snow / Clouds	33.31	15.16	44.51	34.78
Other - Shadow	5.38	8.86	2.96	4.97
Other - Sparsely Vegetated	0.99	4.35	0.84	1.64
Total	**100.00**	**100.00**	**100.00**	**100.00**

Source: Chugach National Forest GIS corporate database.

Vegetative Cover

The Chugach National Forest features a wide array of vegetation diversity that includes both species poor areas and species rich areas. Data used in developing a classification of vegetation types across the National Forest (DeVelice et al. 1999a) were used to summarize this vegetation diversity. The range of vascular plant species richness (total number of species) varies from 68 in sparsely vegetated areas to 441 in shrublands (Figure 3-4a). Table L-1, in Appendix L, documents the range of species richness among community types represented by three or more plots. The range of richness varies from two species in *Puccinellia pumila* graminoid herbaceous communities to 33 in *Picea X lutzii/Equisetum arvense* open needleleaf forests. Table 3-4a also highlights the wide array of vegetation structures across the Chugach National Forest and places the Chugach National Forest vegetation types in the context of vegetation type diversity in the Alaska Region of the USDA Forest Service. The Chugach National Forest includes floristic elements transitional to the Interior of Alaska (e.g., *Picea X lutzii, Betula papyifera, Populus tremuloides*) that are not represented on the Tongass National Forest.

The DeVelice and others (1999a) study recorded 36 percent (569 species) of the total flora of Alaska (as documented in Hulten 1968). Additionally, a total of 282 community types were documented (Figure 3-4b). The greatest community

richness occurred within forest types (152) while the richness of scrub types (55) was lower than herbaceous types (75). Geographically, the number of community types varies from 122 in the Copper River Delta area to 158 in the Kenai Peninsula area of the Forest (Figure 3-4c).

Figure 3-4a: Vascular plant species richness and community richness.

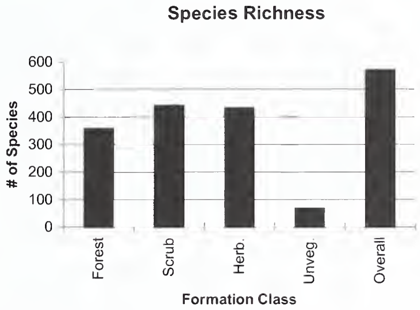


Figure 3-4b: Vascular plant community richness by formation class (i.e., level 1 of Viereck et al. 1992), and community richness.

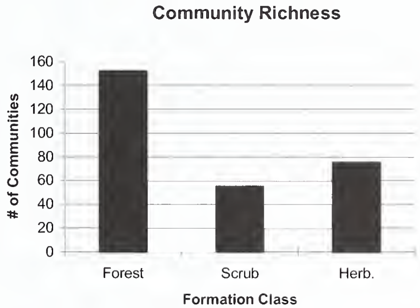
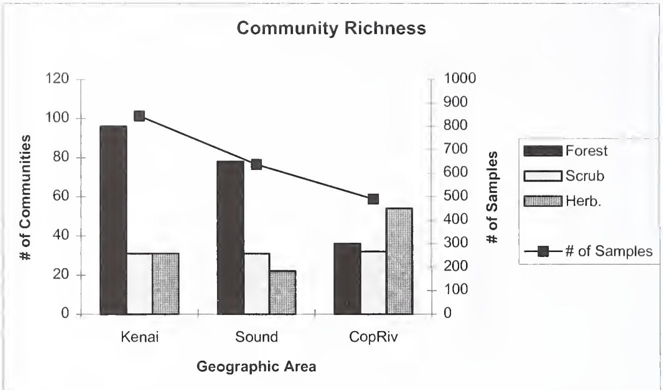


Figure 3-4c: Vascular plant species richness by formation class and geographic area (i.e., Kenai Peninsula, Prince William Sound and Copper River Delta).



The vegetation cover types of the Chugach National Forest can be further delineated by forest dominants through the use of timber and cover type classes and structure (Table 3-13). These photo-interpreted vegetation data are based on photography flown between 1950s and 1970s. (These data do not include ANILCA additions.) Hemlock and hemlock-spruce forests dominate the Chugach forest vegetation (primarily in Prince William Sound). White spruce and Sitka spruce occur less extensively, and deciduous stands of birch and aspen occur primarily on the Kenai Peninsula. Projected changes in cover types in response to spruce beetle-induced mortality and other disturbance factors between the mid 1970s and today is shown in Table 3-15. Alpine vegetation is most common on the Kenai Peninsula, while snow and ice is proportionally greatest in Prince William Sound. On the Copper River Delta willow and Sitka spruce are among the most common plant species.

Table 3-13: Percent cover types of the Chugach National Forest by geographic area (does not include ANILCA additions).

Cover Types	Copper River Delta	Kenai Peninsula	Prince William Sound	Total
Alder	7.59	11.47	0.52	5.46
Aspen	0.00	0.27	0.00	0.09
Birch	0.00	1.48	0.00	0.47
Black Spruce	0.00	0.06	0.00	0.02
Cottonwood	0.97	1.30	0.16	0.69
Grass and Alpine	7.24	26.98	4.84	12.32
Hemlock	7.10	6.64	30.17	17.88
Hemlock-Spruce	7.94	6.34	13.81	10.22
Mixed Hardwood-Softwood	0.23	1.36	0.18	0.56
Muskeg Meadow	1.82	0.22	1.56	1.19
Nonstocked	0.01	0.01	0.03	0.02
Other Brush	6.95	5.50	0.89	3.62
Other Nonforested	5.76	0.50	0.63	1.68
Rock	7.21	16.41	6.41	9.73
Sitka Spruce	9.91	0.99	2.22	3.46
Snow and Ice	10.19	13.45	36.30	23.58
Water	8.03	2.78	2.25	3.64
White Spruce	0.00	3.44	0.00	1.08
Willow	19.05	0.80	0.02	4.30
Total	**100.00**	**100.00**	**100.00**	**100.00**

Source: Chugach National Forest GIS corporate database.

Forest Structure

The forest structure of the Chugach National Forest is primarily in the old mature size class, with a significant proportion of pole timber size class as well (Table 3-14). Forest structure also varies by geographic area. The forests of Prince William Sound are almost entirely in the old mature structural class. Since the mid-1970s about 50,000 acres of forest on the Chugach National Forest portion of the Kenai Peninsula have experienced 70 percent or greater spruce mortality due to the activities of the spruce beetle (USDA Forest Service 1999a, DeLapp et al. 2000). Most of this mortality occurred to trees in the old mature class.

Table 3-14: Percent forest structural classes of the Chugach National Forest (does not include ANILCA additions and forest stands with no structural attributes).

Structural Class	Copper River Delta	Kenai Peninsula	Prince William Sound	Total
Seed/Sap	0.09	2.82	0.51	**3.42**
Pole timber	1.75	18.90	1.63	**22.28**
Young Mature	5.12	1.69	1.01	**7.81**
Old Mature	11.44	7.61	47.44	**66.49**
Total	**18.40**	**31.02**	**50.58**	**100.00**

Source: Chugach National Forest GIS corporate database.

Disturbance

The Kenai Peninsula has historically had the highest levels of disturbance, both natural and human-caused. A relatively long interval fire cycle has prevailed on the Kenai with a recurrence interval of over 500 years. While fire is not

historically frequent in the Kenai, it is much more infrequent in Prince William Sound and Copper River Delta. In the past thirty years, the Kenai Peninsula has received the greatest amounts of active management, wildfire, and bark beetle induced spruce mortality. These disturbances have caused a change in forest cover type and structure, as described in Tables 3-15 and 3-16 and Figures 3-5a and 3-5b.

The Kenai Forest Succession Model (DeLapp et al. 2000) referred to in Tables 3-15 and 3-16 and Figures 3-5a and 3-5b was developed to estimate changes in composition and structure of forest vegetation in the Kenai Mountains over the period 1875 to 2100. Spatially explicit rules were developed to extrapolate forest conditions from 1975 baseline conditions (as represented in the Chugach National Forest GIS corporate database) to pre-European settlement conditions of 1875 and current conditions of 2000. An individual tree based model (i.e., ZILIG, Urban 1990) was used to predict the annual recruitment, growth, and mortality on sites representing the range of conditions in the forested zone for the years 2000 through 2100. Outputs from the ZELIG model were used to build rules to estimate transitions from one forest type to another over time. These rules were applied in a geographic information system to map forest vegetation patterns at the landscape level for the years 2050 and 2100.

Figure 3-5b shows a 54 percent decrease in the proportion of early and mid-successional forests, and a 50 percent increase in the proportion of mature forests is predicted over the next 100 years. Broadleaf forest coverage would decrease about 4.5 percent, mixed forest area would remain stable, and needleleaf forests would increase by about 4.5 percent (Figure 3-5a). Within the needleleaf forest, the proportion of the hemlock type is projected to increase 2.5 percent while the hemlock-spruce and the spruce types would decrease about 1 and 1.5 percent, respectively (Figure 3-5a).

Table 3-15: Changes in forest cover type of the Chugach National Forest portion of the Kenai Peninsula from 1974 to 1999 (National Forest lands only).

Cover type	Acreage in 1974	Percent Forest Acreage 1974	Acreage in 1999	Percent Forest Acreage 1999	Acreage Change	Percent Change
Aspen	2,687	1.2	2,687	1.2	0	0
Birch	12,093	5.5	16,371	7.4	+4,278	+35.0
Cottonwood	14,460	6.6	14,460	6.6	0	0
Hemlock	73,287	33.3	90,281	41.0	+16,994	+23.2
Hemlock-Spruce	61,538	28	44,544	20.2	-16,994	-27.6
Mixed HW-SW	11,432	5.2	7,154	3.2	-4,278	-37.4
Spruce	44,491	20.2	44,491	20.2	0	0

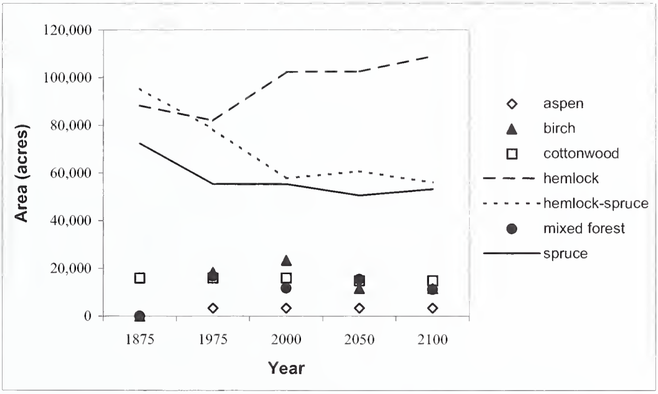
Source: Chugach National Forest GIS corporate database and Kenai Forest Succession Model (DeLapp et al. 2000).

Table 3-16: Changes in forest size class distribution of the Chugach National Forest portion of the Kenai Peninsula from 1974-1999 (NF lands only).

Structure Class	Acreage in 1974	Percent Forest Acreage in 1974	Acreage in 1999	Percent Forest Acreage in 1999	Acreage Change	Percent Change
None	42,233	19.2	39,676	18.0	-2557	-6.0
Seed/Sapling	14,494	6.6	18,795	8.5	+4301	+29.7
Pole	111,010	50.5	103,311	47.0	-7701	-6.9
Young Saw	9254	4.2	8334	3.8	-920	-9.9
Old Saw	42,997	19.5	35,298	16.0	-7699	-17.9
Standing Dead	0	0	14,574	16.6	+14574	

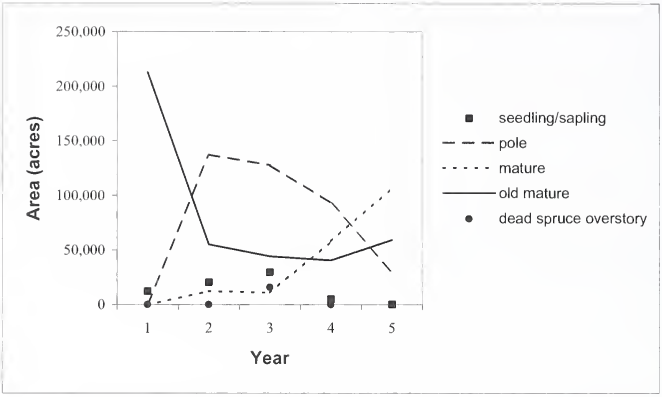
Source: Chugach National Forest GIS corporate database and Kenai Forest Succession Model (DeLapp et al. 2000).

Figure 3-5a: Area distribution of forested cover types on the Kenai Peninsula portion of the Chugach National Forest in the 1975 baseline[1] and estimated for the years 1875, 2000, 2050, and 2100 using the Kenai Forest Succession Model.



[1] Summarized from Chugach National Forest GIS corporate database.
Source: DeLapp et al. 2000.

Figure 3-5b: Area distribution of tree age classes on the Kenai Peninsula portion of the Chugach National Forest in the 1975 baseline[1] and estimated for the years 1875, 2000, 2050, and 2100 using the Kenai Forest Succession Model.



[1] Summarized from Chugach National Forest GIS corporate database.
Source: DeLapp et al. 2000.

Habitat Diversity Model

Survey data documenting the distribution of all plant and animal species across the Chugach National Forest are not presently available. The distribution of plants and animals is strongly influenced by physical environmental gradients (Whittaker 1967), which are generally specified by radiation, thermal, moisture, nutrient, and biotic regimes (Nix 1982). In the absence of distribution data for all species, specification of the dominant environmental regimes may provide surrogates for plant and animal communities and habitats (Mackey et al. 1988). The national hierarchical framework of ecological units (ECOMAP 1993) at the Landtype phase level (the smallest unit recognized in the hierarchy) would provide an effective surrogate of biological diversity at the landscape level. However, a Landtype phase level coverage across the Chugach National Forest is not presently available. To provide a summary representation of environmental regimes across the Forest, a habitat diversity model was developed by DeVelice and others (1999a) by combining the following GIS layers into a single series of 217 “bioenvironmental domains” or classes (note: the final grid used was resampled to 400 meters to create 40 acre grid cells).

- Bioclimate (BC) - grid (60 meter cell size) - described by DeVelice and Hagenstein (1995): This grid summarizes moisture, temperature, and radiation regimes. The grid was developed by extrapolating weather data from five discrete stations using the MTCLIM simulation model (Hungerford et al. 1989, Running et al. 1987) and classifying the results using a hierarchical clustering

algorithm (Belbin 1993, Belbin et al. 1992). In the application used here, the first eight cluster groups representing the range of bioclimates were used as the classes.

- Landcover characterization (LCC) - grid (30 meter cell size) - described by Markon and Williams (1996): This grid summarizes those components of the biotic regime specified by vegetation cover. The grid was developed from satellite imagery including data from Landsat thematic mapper, Landsat multispectral scanner, and SPOT multispectral scanner. The different data types were necessary to provide near-complete, cloud-free coverage of the forest. Dates of images range from August 1977 to August 1991. Image classification involved the use of standardized isodata and Baysian classifiers (Swain and Davis 1978, Fleming 1988). The Classification used by Markon and Williams (1996) approximates level 3 of the Alaska Vegetation Classification (Viereck et al. 1992). In the application used here, the 25 classes in the Markon and Williams (1996) were aggregated into six broader classes approximating level 1 of Viereck et al. (1992), but with the inclusion of both a tall and a low shrub class.
- Landtype association (LTA) - polygon (converted to grid - using "Polygrid") - LTA classification described by Davidson (1998): This grid was used as a surrogate for nutrient regimes and as a modifier of moisture, temperature, and radiation regimes. Davidson (1998) mapped the 11 landtype association classes (8 land and 3 water classes) using air photo interpretation and topographic maps. In the application used here, the 11 classes of Davidson (1998) were aggregated into six broader classes primarily relating to mass transport (e.g., source areas such as mountain summits, transport areas such as sideslopes, depositional areas such as moraines and outwash).

This combination of climate (BC), land cover (LCC), and land form (LTA) serves as a generalized measure of the distribution of habitat types across the Chugach. These components are defined in Table 3-17.

Table 3-17: Summary description and percent coverage of the bioenvironmental components of the bioenvironmental domains of the Chugach National Forest (see DeVelice 1998 for details).[1]

BC Code	Bioclimate Class Aggregate	Percent
1	Dry and mesic Copper River Delta	6.35
2	Wet and hydric Copper River Delta, hydric Prince William Sound	2.04
3	Non-hydric Prince William Sound and Glacier -	25.29
4	Non-hydric Prince William Sound and Glacier +	41.59
5	Hydric Glacier	5.50
6	Kenai -	17.28
7	Kenai +	0.35
8	Tasnuna	1.60
	Total	**100.00**
LCC Code	**Land Cover Class Aggregate**	**Percent**
1	Forests and dwarf tree scrub	22.80
2	Tall scrub	8.90
3	Low scrub	4.88
4	Herbaceous	8.45
5	Barren	49.29
6	Water, shadow, and unmapped	5.68
	Total	**100.00**
LTA Code	**Land Type Association Aggregate**	**Percent**
1	Glaciers	40.09
2	Mountain summits	18.41
3	Hills and mountain sideslopes	29.19
4	Depositional slopes, moraines, outwash (inc. fluvial valley bottoms)	8.46
5	Coastal	2.51
6	Water	1.34
	Total	**100.00**

[1] The plus and minus signs of bioclimate class numbers 3 and 4 and 6 and 7 distinguish between the lower elevation conditions (-) and higher elevations (+).

The majority of bioenvironmental domain or classes occupy less than one percent of the Forest, with the ten classes with the greatest acreage occupying over 65 percent of the Forest and the remaining 207 classes occupying less than 35 percent (Table 3-18). As this table illustrates, the Chugach is a land primarily of snow and ice. The single most widespread bioenvironmental domain consists of non-hydric Prince William Sound and Glacier +, barren land cover, and glacial land type (451), occupying over 28 percent of the Forest. The most dominant vegetated bioenvironmental domain, occupying over 10 percent of the Forest, consists of non-hydric Prince William Sound and Glacier - bioclimate, forests and dwarf tree scrub land cover, on hills and mountain sideslopes land type (313).

Table 3-18: Top ten (out of 217) bioenvironmental classes of the Chugach National Forest.

#	Bioclimate Class	Land Cover Class	Land Type Association	Acres	Percent	Cumulative Percent
451	Non-hydric PWS and Glacier +	Barren	Glaciers	1,506,817	28.02	28.02
313	Non-hydric PWS and Glacier -	Forests and dwarf tree scrub	Hills and mountain sideslopes	574,812	10.69	38.70
351	Non-hydric PWS and Glacier -	Barren	Glaciers	267,013	4.96	43.67
551	Hydric glacier	Barren	Glaciers	257,104	4.78	48.45
452	Non-hydric PWS and Glacier +	Barren	Mountain summits	232,429	4.32	52.77
613	Kenai -	Forests and dwarf tree scrub	Hills and mountain sideslopes	172,475	3.21	55.98
413	Non-hydric PWS and Glacier +	Forests and dwarf tree scrub	Hills and mountain sideslopes	149,389	2.78	58.75
623	Kenai -	Tall scrub	Hills and mountain sideslopes	127,082	2.36	61.12
652	Kenai -	Barren	Mountain summits	119,423	2.22	63.34
352	Non-hydric PWS and Glacier -	Barren	Mountain summits	99,332	1.85	65.18

Source: Chugach National Forest GIS corporate database.

Expected Range of Variability (ERV)

By assessing the history of disturbance regimes on the Chugach National Forest, what ecological conditions were like in the region of the Forest before European settlement became significant in the nineteenth century can be surmised. How these conditions have changed as a result of natural and human influences in the years since the settlement period began can be recorded. Some conditions will essentially be unchanged while others may have departed significantly from earlier norms. Some conditions that had changed will have done so because such variability is natural; many ecosystems have evolved on the basis of these fluctuations. These conditions can be said to be within their expected range of variability (ERV). Other conditions will have changed, because of human intervention, to a point that is not within the range of long-term fluctuations that is natural to them. These then are considered to be outside their ERV.

The Kenai Peninsula is the focus of the following discussion on ERV since it is where the bulk of historic and proposed human activities have occurred on the Chugach National Forest. Perhaps the best available information for estimating ERV in vegetation composition over periods greater than the last 200 years are variations in fossil pollen abundances preserved in peat deposits. Vegetation composition may not be precisely inferred from pollen percentages, because of such factors as species variations in pollen production, preservation, and dispersal (Ager personal communication). However, pollen percentage data can be used to provide a general sense of trends in vegetation composition.

Within the Chugach National Forest portion of the Kenai Peninsula the only pollen record described is for a site at Tern Lake (Ager 2000b). The record for this site spans about 9,800 years when peat began accumulating after glacial ice

melted away. According to Ager (2000b) the local vegetation in the Tern Lake area today developed within the past 2,500 years. This suggests that the past 2,500 years may be a useful interval for studying the ERV in forests of the Kenai Mountains (Ager personal communication).

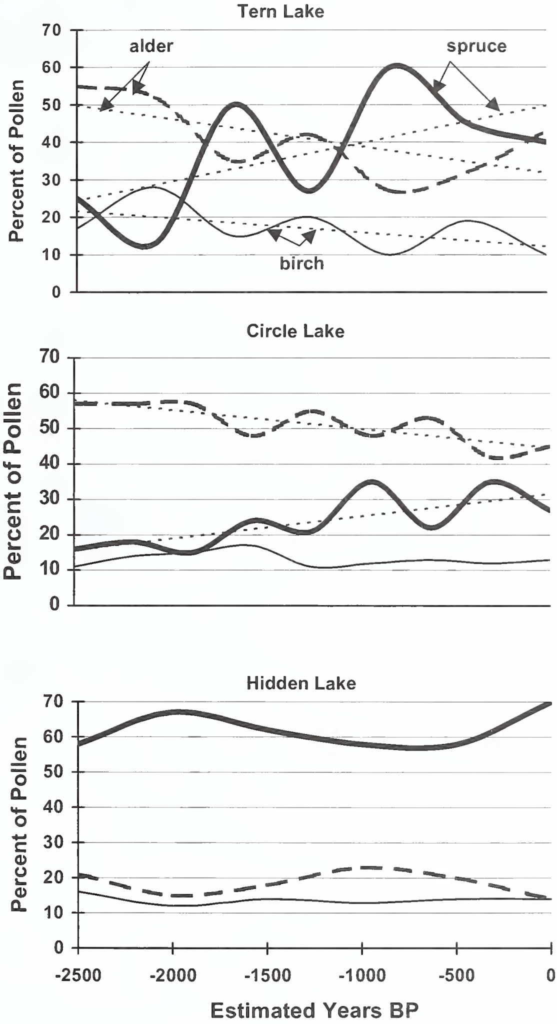
Variation in pollen abundances for sites at Tern Lake (Ager 2000b), Circle Lake near Homer (Ager 2000a), and Hidden Lake on the Kenai Lowlands (Ager 1983) are shown in Figure 3-6. Of these three sites, Tern Lake is perhaps most representative of changes occurring on the National Forest since it is the only site in the Kenai Mountains (the portion of the Peninsula where the National Forest is located). It is expected that variations in pollen abundances would occur from site to site within the Kenai Mountains and these variations may equal or exceed the variations occurring among the three sites summarized in Figure 3-6. To more accurately index ERV across the National Forest, a fossil pollen study is needed where the sample sites represent the range of conditions across the Forest.

At both Tern Lake and Circle Lake, there is a trend of increasing abundance of spruce pollen and decreasing abundance of alder pollen (Figure 3-6). Patterns of pollen abundance at Hidden Lake have been relatively stable over the last 2,500 years (although this apparent stability may be an artifact of the 10 cm sampling interval). At Tern Lake, spruce pollen abundance increases from about 25 percent 2,500 years ago to about 50 percent at present. This suggests a progressive expansion of coniferous forest into shrublands over the last 2,500 years at Tern Lake. It is suspected that this process of conifer range expansion in the Kenai Mountains is still underway (Ager personal communication).

Spruce pollen abundance at Tern Lake appears to have fluctuated markedly over the last 2,500 years (Figure 3-6). However, Ager (personal communication) cautions about over-interpreting the significance of the spruce oscillations suggested at Tern Lake since they may be an artifact of variable preservation of the pollen at the site.

In summary, based on the limited pollen evidence, the ERV of forest species abundance is high. The ERV includes both long periods (>500 years) of shrub dominance and long periods of conifer dominance. In the first decade, a total of about 36,000 acres of vegetation treatment (about 27,000 acres of which is prescribed burning) would occur under the Preferred Alternative. This acreage represents less than 5 percent of the vegetated land on the National Forest portion of the Kenai Peninsula, and less than one percent of the entire area of the National Forest. It is logical to infer that the magnitude of the ERV greatly exceeds the magnitude of proposed vegetation treatments under the Preferred Alternative, i.e., the proposed treatments are within the ERV.

Figure 3-6: Pollen percentages over approximately the last 2,500 years from sites at Tern Lake, Circle Lake and Hidden Lake (summarized from Ager 2000b, 2000a, and 1983, respectively). The fine dashed lines shown are trend lines. The Tern Lake data are based on samples at 5 cm intervals while samples at Circle and Hidden lakes were at 10 cm intervals.

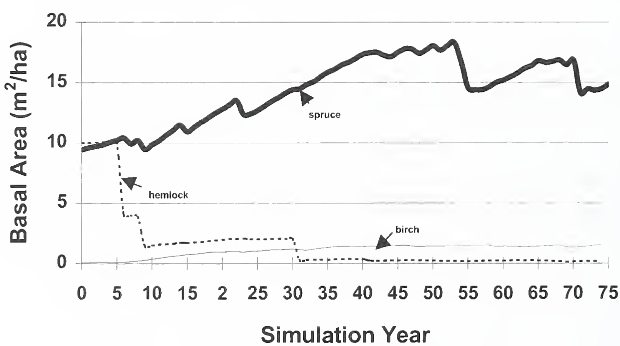


Given the prospect of global climate change (Berg and DeVolder 2001) it is uncertain whether the gradual trend of forest expansion will continue. To predict potential forest changes at a site in response to global climatic change a succession model (i.e., ZELIG, Urban 1990) was used. ZELIG is an individual tree based model that tracks the annual recruitment, growth, and mortality of individual trees at discreet sites. Annual changes are simulated by calculating the growth increment of each tree, tabulating the addition of new saplings, and tabulating the death of trees. These processes are all stochastic functions in the model.

Output from ZELIG for a site at 1,000-foot (300 meter) elevation in the Kenai is shown in Figure 3-7a. In this simulation, temperatures were increased instantaneously from a maximum of 7°C in January to a minimum of 1°C in June. The magnitude of these changes is representative of climatic changes predicted by general circulation models. However, such an increase in temperature would more realistically be expected to increase gradually rather than instantaneously. Thus, the projections of Figure 3-7a likely show a much more rapid change in composition than would actually occur.

The most striking feature of the predictions shown in Figure 3-7a is a large drop in hemlock basal area. Basically, the model predicts the more cold demanding hemlock would become a minor component of the simulation stand after a drop from co-dominance with spruce. In contrast, in climate change simulations for higher elevations (e.g., 3,000 feet), hemlock occurrence expands as temperatures that were previously too cold become favorable.

Figure 3-7a: Predicted changes in tree basal area in response to climatic change for a site in the Kenai Mountains at 300 meter elevation, on a westerly aspect with a slope of 25 percent.[1]



[1] The initial hemlock-spruce stand composition is from field data. Mean monthly temperatures were increased instantaneously at the start of the simulation from a maximum of 7°C in January to a minimum of 1°C in June.

Wildlife

The range of one bird species (Kenai song sparrow) and seven subspecies of mammals (one extinct) are restricted to the Kenai Peninsula. One subspecies occurs primarily on the Kenai Peninsula, but its range extends to Palmer, Alaska. Three subspecies of small mammals are restricted to the islands and mainland of Prince William Sound.

One subspecies of gray wolf (*Canis lupis alces*), from Kachemak Bay, Alaska, is now extinct, and caribou were extirpated from the Kenai Peninsula and were reintroduced. The Montague Island hoary marmot has not been observed since the mid-seventies, and no specimens have been collected since the initial collections near the turn of the century.

Mink and deer were introduced onto islands in Prince William Sound, and moose were introduced to the Copper River Delta.

Wolves were historically absent or very rare on the Copper River Delta until the early seventies. The wolves have established a small population on the Copper River Delta.

Wolves and caribou on the Kenai Peninsula are at the lower range of ERV. Dall sheep, moose, and mountain goats are within the ERV on the Kenai.

Human uses

Modern settlement within the boundaries of the Chugach National Forest, which became significant during the latter half of the nineteenth century, significantly changed some Chugach ecosystems, particularly due to anthropogenic wildfires within the forested zones of the Kenai Peninsula. Much of terrestrial areas of Prince William Sound and the Copper River area have received minimal human impact to the present day. Prior to the nineteenth century, human impacts on ecosystems are considered to have been limited.

Fires, mining activities, logging, and railroad construction changed vegetation patterns during the early twentieth century on the Kenai Peninsula. Fire suppression during the latter half of the twentieth century has limited the extent of recent wildfires.

Forested and Nonforested Vegetation

Forest composition is within ERV except within localized, heavily managed areas such as road corridors.

On the Kenai Peninsula there is a history of long interval large stand replacing fires (Potkin 1997). Immediately prior to European settlement forests on the Kenai were dominated by mature stands of hemlock and spruce, with deciduous stands of a more limited extent than the present day (Langille 1904, Potkin 1997).

The Copper River Delta has a long history of tectonic activity, with a record of long interval localized uplift and/or subsidence. Most recently, the 1964 Good Friday Earthquake caused areas of the Delta to uplift up to eleven feet, resulting in a change in vegetation from open grass dominated communities to a greater proportion of shrub and tree species.

Since data describing forest structural changes across the last 2,500 years are not available, it is uncertain how existing forest structure compares to the ERV. However, the large changes in vegetation composition documented across the last 2,500 years at the Tern lake site on the Kenai Peninsula (Figure 3-6, Ager 2000b) likely correspond to a large range in forest structures over the ERV period. This suggests that present forest structure is within the ERV. The current extent and composition of non-forested vegetation is within the ERV.

Climate

In a climatic change study conducted at Kepler Lake (about 50 miles north of the Kenai Peninsula), three distinct climatic periods are described spanning about the last 2,500 years (Forester et al. 1989). Relative to today, a warmer and perhaps seasonally drier period occurred from about 2,500 to 750 years ago, a colder and perhaps drier period occurred between 750 to about 140 years ago, and the present climatic conditions have been in effect from 140 years ago to today. Given this variability over the last 2,500 years, precipitation, snowfall accumulation and temperatures on the Chugach National Forest are likely all within ERV. However, anecdotal evidence of drying lakes on the western Kenai may indicate possible long-term trends of warmer and drier weather (Berg personal communication).

Fire

Because of the rarity of lightning strikes on the Chugach National Forest, natural fires are rare (Potkin 1997). However, with the increase in human activity on the Kenai Peninsula portion of the National Forest near the turn of the 20th century, widespread fire disturbance occurred since that time. In fact, an estimated 1,400 fires have burned a combined 75,000 acres on the Kenai Peninsula portion of the Forest from 1914 to 1997 (Potkin 1997). Human-caused ignitions account for over 99 percent of these fires. This suggests that the current frequency of fires is in excess of the ERV.

While rare, natural fires did occur of the Kenai Peninsula portion of the Forest before the turn of the 20th century. Radiocarbon dates of charcoal samples from soils at scattered locations in the Kenai Mountains ranged from 3,010 to 570 years before present with an average of 600 years between dates (Potkin 1997). Charcoal has been reported as present in most soil pits within the forested zone

in the Kenai Mountains (Davidson personal communication). This suggests the occurrence of widespread, yet infrequent, fires in prehistoric times. The extent of fires may be at the lower end of the ERV due to fire suppression efforts controlling many of the fires, which would have burned more acreage without human intervention.

As a result of the current spruce beetle infestation in combination with fire suppression, the accumulation of litter, standing dead trees, and downed material in many spruce stands on the Kenai Peninsula portion of the Forest may be at the high end of the ERV.

Insects and diseases

Spruce beetles were almost certainly an important component of the spruce forests of the Kenai prior to European settlement. Since the mid 1970s, almost 25 percent of the forest area on the Kenai Peninsula portion of the Chugach National Forest has experienced 70 percent or greater spruce mortality as a result of spruce beetle activity. Data describing spruce beetle population fluctuations across the last 2,500 years are not available, so it is uncertain how the extent and intensity of the existing outbreak compares to the ERV. However, the large changes in vegetation composition documented across the last 2,500 years at the Tern Lake site on the Kenai Peninsula (Figure 3-6) suggests that present forest composition, as affected by the spruce beetle, may be within the ERV (Ager 2000b).

One means of examining the ERV on the Chugach National Forest is to compare the proportion of land cover classes within the perimeter of the Forest boundary with those classes occurring only on Chugach National Forest lands (Table 3-19). The proportion of land cover classes is not significantly different on and off National Forest System lands within the Forest boundary. There is slightly more closed needleleaf forest on non-National Forest lands within the Forest boundary than on National Forest lands. This is due primarily to the fact that most land exchanges have taken place within this vegetation zone, such as along the Seward Highway on the Kenai Peninsula. However the proportion is slight. In large part, the land cover of the Chugach National Forest does not differ from the land cover on lands of other ownership within the Forest boundary.

Table 3-19: Area and proportion of land cover types within the perimeter of the Chugach National Forest boundary – a comparison of National Forest System (NFS) lands with all land ownerships including inholdings.

Land Cover Class	NFS Lands	Total w/in Boundary	Percent NFS Lands	Percent Total within Boundary
Forest - needleleaf - closed	598,470	791,770	10.92	12.56
Forest - needleleaf - open	115,680	149,280	2.11	2.37
Forest - needleleaf - woodland	97,940	121,580	1.79	1.93
Forest - Broadleaf - Closed	129,920	159,170	2.37	2.52
Forest - Broadleaf - open	9,650	24,910	0.18	0.40
Forest - Mixed - Closed	6,360	7,060	0.12	0.11
Forest - Mixed - Open	3,080	3,310	0.06	0.05
Scrub - Dwarf Tree - Open	28,070	34,400	0.51	0.55
Scrub - Tall shrub - Closed	498,150	615,540	9.09	9.76
Scrub - Tall shrub - Open	74,530	81,500	1.36	1.29
Scrub - Low shrub - Closed	288,870	330,410	5.27	5.24
Scrub - Low shrub - Open	139,840	167,530	2.55	2.66
Herb - Graminoid / Forb - Dry/Mesic	369,590	412,200	6.74	6.54
Herb - Graminoid / Forb -Wet	124,320	143,420	2.27	2.27
Herb - Bryoid - Mosses	4,620	4,770	0.08	0.08
Herb - Bryoid - Lichens	30,170	30,180	0.55	0.48
Herb - Aquatic - Fresh	9,530	9,610	0.17	0.15
Herb - Aquatic - Brackish	1,640	1,790	0.03	0.03
Water - Salt - Clear	16,760	23,560	0.31	0.37
Water - Salt - Turbid	173,930	202,480	3.17	3.21
Barren - Unconsolidated or Bedrock	468,860	519,150	8.55	8.23
Barren - Sand / Mud	23,010	23,660	0.42	0.38
Other - Ice / Snow / Clouds	1,906,720	2,043,200	34.78	32.41
Other - Shadow	272,340	302,930	4.97	4.80
Other - Sparsely Vegetated	89,700	101,760	1.64	1.61
Total	**5,481,750**	**6,305,170**	**100**	**100**

Wildlife

Habitat Classification and Scoring

Changes in biodiversity for wildlife can frequently be characterized as a gradual and incremental fragmentation of habitats where no single management decision causes significant harm, but the cumulative impact of many decisions contributes to a viability concern. A comparison of wildlife habitat distribution to land ownership patterns and stewardship at a variety of landscape scales was used to assess the amount of responsibility for management of the wildlife habitat in relationship with other land stewards of the area who share that responsibility (Crist 2000).

The coarse filter analysis for wildlife first looked at the distribution of land ownership within the ecoregions and used different landscape scales down to the Forest level, to put the Chugach into context within the landscape. Following the ecoregions analysis, the distribution of wildlife species within the Forest by using land cover classifications and habitats of special interest were determined. The species richness of habitat use by wildlife species to the relative degree of management commitment to maintaining biodiversity within the Forest at multiple landscape scales was compared.

A crosswalk of Forest Management Prescriptions Categories to the land the protection status of Duffy and others (1999) was developed. Using this protection scheme allowed us to classify species richness according to prescription category, with Category 1 and 2 prescriptions corresponding roughly to the “protected” status, (protection Status 1 and 2 of Duffy and others (1999)). The more ”multiple use” prescription Categories 3, 4, and 5 offer “moderate” levels of protection to ecosystem processes and the diversity of native species (protection Status 3 of Duffy and others (1999)). A review of the literature was conducted for nearly all of the species and subspecies listed in Suring and Murphy (1998) as present on the Chugach National Forest. Two mammal species and eleven bird species were not described. Habitat use by each species was reviewed. For birds, the use of habitat was classified for breeding, migration and winter season. Mammal and amphibian habitat requirements were classified for breeding and winter seasons.

Potential wildlife habitat for each species was determined using Forestwide land cover classifications. The following habitats were also used to determine species richness in those habitat areas not well represented using the land cover classification: Alpine, Beach and Tideflat Coast, Beach Fringe, Estuarine, Limnetic Lacustrine, Littoral Lacustrine, Palustrine, Riparian, Rocky Coast, Sheltered Inshore Waters and Subtidal/Intertidal.

The vegetation patterns of the Chugach are very heterogeneous. At the landscape scale, the diversity of landforms and drainage patterns influences vegetative cover: peatlands (muskegs) are characteristic of poorly drained soils; conifer forests of well-drained soils, sparse “scrub” forests of intermediate areas; and, broadleaf forests indicators of early succession following fires or other disturbances like wind or avalanches. At a smaller scale, similar vegetative patterns are common, with small patches of poorly drained non-forested areas found within mature or old growth forests for instance, or a large stand of trees in riparian soils within a larger area of wetland. The mix of land cover classes and seral conditions are important to the overall diversity of habitats.

Landscape Position. Where the vegetation occurs on the landscape is also an important component of bird and mammal biodiversity. The landscape positions and proximity to fresh or salt water are described below. These habitat areas are referred to as habitats of special interest.

Freshwater. The freshwater/vegetation interface is an important biodiversity component. These areas are associated with small wetlands and lakes including the shorelines. Littoral wetlands are represented by an approximate 50-foot buffer lakeward of the shoreline.

Alpine. These are all upland areas over 1,500 feet in elevation, excluding the beach and estuary fringe and riparian zones.

Riparian. These are a minimum of 100-foot-wide zone along both sides of all inventoried streams, excluding the beach fringe. The riparian areas adjacent to anadromous streams are thought to play a significant role in the transfer of nutrients from the marine to terrestrial ecosystems.

The following landscape positions apply to the salt-water shorelines. These areas are often forested and are thought to be important as wildlife travel corridors, transition zones between interior forests and salt-water influences, and also as a unique habitat or microclimate. The adjacent forest and freshwater location and beach substrate provides important horizontal or low-elevation connectivity between watersheds, many of which have very steep sides and/or non-forested ridge tops.

Beach Association. Beach and Estuary Fringe are represented by an approximately 1,000-foot (300 meter) buffer inland from the coastline. The Beach Fringe, Beach and Tideflat Coast, in conjunction with riparian areas, provide connectivity within watersheds. These areas are a major component of the travel corridors used by the many associated wildlife species. These areas also provide critical seasonal feeding and resting habitats for avian migrants, particularly the neo-tropical migrants.

Rocky Coast. This zone is composed of bedrock, and may provide a variety of substrate conditions depending on the exposure to prevailing winds and wave action. In these locations, there is strong vertical zonation of intertidal biological communities; species density and diversity vary greatly, but barnacles, snails, mussels, and macroalgae dominate. There is a great diversity of birds and mammals that use these areas.

Sheltered Inshore Waters. These areas are characterized as having little vegetation. However, due to the soft sediment deposits, there can be large concentrations of shellfish, polychaetes and snails in and on the sediments. These areas provide feeding and resting habitats for approximately 20 percent of the birds and mammals on the Forest.

A value from 0 – 3 (Table 3-20) was assigned to each habitat type by season (mammals and amphibians – summer/winter; birds – summer/migration/winter). If a species received all 0s during a given season, it is not known to exist on the Chugach that time of year. For the analysis, 0 - no value, 1 - low value, 2 – moderate value, and 3 – high value were considered. Each species was assigned a rating system value for each land cover classification and for each habitats of special interest. The values were recorded by species and habitat in a spreadsheet matrix. These values were also used to create Geographic Information System (GIS) files that were used to spatially array the values of the habitats associated with each species.

Table 3-20: Rating system used for scoring habitat types in species diversity matrix.
0 = Nothing in the literature suggests that the species will use this habitat.
1 = The species rarely uses this habitat, or inferences were made from the literature that the species could be using this habitat.
2 = The species uses this as habitat for feeding, refuge, or as a secondary breeding habitat.
3 = The species requires this habitat for multiple aspects of its life cycle: breeding, feeding, and refuge.

Of 244 species identified by Suring and Murphy (1998), only 231 were included in the matrix. Two mammal species and eleven bird species were not described. The first mammal is an extinct subspecies of gray wolf (*Canis lupis alces*) from

Kachemak Bay, Alaska, and the second is the northern fur seal (*Callorhinus ursinus*). The fur seal breeds in remote rookeries on the Pribilof Islands and is highly pelagic the rest of the year in the Gulf of Alaska and coastal waters of western North America. It is only a rare or accidental visitor to the Forest's coast. Eleven species of pelagic seabirds were also removed from the list. These species primarily occur in inshore and offshore waters of Prince William Sound and the Gulf of Alaska or are accidental visitors. They do not breed on National Forest lands. Many of them breed in the southern hemisphere and are only common in the offshore waters of Alaska during the summer months. The Forest does not directly provide habitat for these pelagic species, pending settlement of disputed saltwater ownership.

This species rating system allowed us to begin to quantitatively describe the habitats available for use by wildlife species on the Forest.

Analyses were made of potential species diversity by habitat type (landcover classification) and season. Table 3-21 shows the numbers of species that use the land cover classes and habitats of special interest by season. Wildlife use of the various land cover classes and habitats of special interest varies seasonally, and all habitat types are important habitats for wildlife sometime during the year.

Table 3-21: Numbers of species using the land cover classes and habitats of special interest by season.

Land Cover Class	Summer No. of Species	Summer % total species	Migration No. of Species	Migration % total species	Winter No. of Species	Winter % total species	Total No. of Species	Total % total species
Forest Needleleaf Closed	56	24	29	13	43	19	61	26
Forest Needleleaf Open	92	40	44	19	66	29	99	43
Forest Needleleaf Woodland	103	45	54	23	56	24	114	49
Forest Broadleaf Closed	34	15	15	6	26	11	40	17
Forest Broadleaf Open	62	27	29	13	40	17	70	30
Forest Mixed Closed	56	24	28	12	42	18	57	25
Forest Mixed Open	89	39	43	19	57	25	89	39
Tall Shrub Closed	31	13	25	11	18	8	42	18
Tall Shrub/Dwarf Tree Open	54	23	34	15	31	13	66	29
Low Shrub Closed	36	16	15	6	16	7	41	18
Low Shrub Open	77	33	30	13	33	14	86	37
Herb-Graminoid/Forb Dry/Mesic	61	26	27	12	28	12	71	31
Herb/Graminoid/Forb Wet	80	35	36	16	21	9	89	39
Herb/Bryoid/Mosses/Lichens	48	21	17	7	26	11	53	23
Sparsely Vegetated	35	15	14	6	15	6	46	20
Subtidal/Intertidal Estuarine	42	18	68	29	37	16	85	37
Limnetic Lacustrine	20	9	20	9	4	2	30	13
Littoral Lacustrine	62	27	38	16	13	6	76	33
Palustrine	92	40	55	24	26	11	106	46
Alpine	61	26	13	6	23	10	64	28
Riparian	87	38	48	21	41	18	96	42
Rocky Coast	23	10	21	9	18	8	33	14
Beach and Tideflat Coast	26	11	38	16	20	9	52	23
Beach Fringe	37	16	34	15	19	8	50	22
Sheltered Inshore Waters	25	11	36	16	34	15	47	20

Species associated with these landcover types require or use the type for one or more life functions, such as breeding, feeding, and refuge (i.e., species rated with 2s and 3s in the matrix).
Additional species on the Forest use these cover types only rarely or it was inferred from the literature that they could be using them (i.e., species rated with 1s in the matrix). These species were not included in the analysis for that LCC type.
There are numerous species associated with inshore and offshore waters of Prince William Sound and the Copper River Delta that do not use tidal or upland habitat and were not included in the matrix. (11 bird species, 1 marine mammal (accidental))
Land Cover Classes and subclasses from Markon and Williams. 1996.

Land cover classes and habitats of special interest were aggregated to portray species richness of general habitats of the Forest. Table 3-22 crosswalks the fine scale land cover classes and habitats of special interest to the general habitat types.

Table 3-22: Numbers of species using the land cover classes and habitats of special interest by season.

Land Cover Class	Broad Land Cover Class	Summer No. Of Species	Summer % Total Species	Migration No. Of Species	Migration % Total Species	Winter No. Of Species	Winter % Total Species	Total No. Of Species	Total % Total Species
Forest Needleleaf Closed Forest Needleleaf Open Forest Needleleaf Woodland Forest Broadleaf Closed Forest Broadleaf Open Forest Mixed Closed Forest Mixed Open	Forested	132	57	63	27	80	35	137	59
Tall Shrub Closed Tall Shrub/Dwarf Tree Open Low Shrub Closed Low Shrub Open	Scrub	106	46	54	23	50	22	119	52
Herb-Graminoid/Forb Dry/Mesic Herb/Graminoid/Forb Wet Herb/Bryoid/Mosses/ Lichens	Herb-Gram-Moss-Lich	110	48	47	20	39	17	120	52
Sparsely Vegetated	Sparsely Vegetated	35	15	14	6	15	6	46	20
Subtidal/Intertidal Estuarine	Tidal Estuarine	42	18	69	30	37	16	86	37
Limnetic Lacustrine Littoral Lacustrine Palustrine	Freshwater	103	45	69	30	31	13	121	52
Alpine	Alpine	61	26	13	6	23	10	64	28
Riparian	Riparian	87	38	48	21	41	18	96	42
Rocky Coast	Rocky Coast	23	10	21	9	18	8	33	14
Beach and Tideflat Coast Beach Fringe	Beach Assoc.	47	20	55	24	30	13	75	32
Sheltered Inshore Waters	Sheltered Inshore Waters	25	11	36	16	34	15	47	20

Classes and subclasses from Markon and Williams, 1996.

Structure, for this analysis is: "the extent to which the landscape pattern of the ecosystem provides for biological flows that sustain animal and plant populations." Two elements were considered for the analysis, fragmentation and connectivity, including corridors.

Fragmentation of habitats has been implicated in the decline of biological diversity and the ability of ecosystems to recover from disturbances (Flather et al. 1992). Habitat fragmentation is the process by which a natural landscape is broken up into small patches of natural ecosystems, isolated from one another in a matrix of lands dominated by human activities (Hunter 1996).

Fragmentation and Perforation

Fragmentation. Fragmentation is defined as the breaking out of contiguous blocks of habitat into progressively smaller patches that are increasingly isolated from one another. It may also be viewed as the process of interspersed in blocks of suitable habitat with the areas that are hostile to plant or animal life, such as highways or urban development. Fragmentation should be viewed in the concept of changes from the baseline condition some landscapes are naturally patchy while others are relatively uniform. Fragmentation factors would affect these two landscapes and the species that use them in different manners.

The assumption should not be made that the Chugach National Forest was once a vast expanse of unbroken forest. The Forest has a high degree of natural patchiness. Large-scale disturbance events such as tectonic uplift, insect epidemics, large and small-scale wind throw events, and avalanches are part of the area's natural history; coupled with slope, aspect, soil, and elevational differences, they are responsible for a diverse array of forested and nonforested landscape patterns. Moreover, these definitions do not address the question of how long these isolations last. Much other research on fragmentation has focused on changes from agriculture or urban development, which are long-term and permanent in nature. By contrast, most alterations from timber sales or other forest management activities are relatively temporary.

An important consideration is how fragmentation affects different species. Not all species of animals or plants are affected in the same way. A major highway corridor may significantly affect habitat of small mammals by bisecting it. This may have little impact on birds that can readily fly over it.

Perforation. Perforation refers to holes within otherwise contiguous blocks of habitat. An example could be a clear-cut (or group of clear cuts) surrounded by late-successional forest. These cutting units may or may not mimic natural conditions, depending upon the size and shape of cut, and many other factors. Many of the changes associated with management of National Forest System lands represent perforation rather than fragmentation of suitable habitat. They generally are not considered to be fragmentation factors in the traditional sense, and may or may not affect habitat capabilities for species.

Factors considered in this analysis included those listed below. A quantitative analysis of the patch size or fragmentation was not conducted. Since 1974 there has been a total of 7,785 acres treated on the Forest, almost 55 percent of which

was prescribed burning. The remainder, about 300 acres per year (mostly timber harvest and firewood harvest) has taken place in response to the spruce bark beetle epidemic all on the Kenai Peninsula. So very little of the management activity has contributed to changes in existing patch size.

The proposed timber harvest for Alternatives A and B and the No Action Alternative would occur within four watershed associations. Concentrating the timber harvest in these watershed associations harvests would increase effective patch size and minimize fragmentation.

The Revised Forest Plan standards and guidelines are intended to minimize the effects of timber harvest and other management activities on the pattern and connectivity of habitats. The application of these standards and guidelines is expected to result in managed stands that will have a mosaic of uneven sizes and shapes. The Revised Forest Plan standards and guidelines will also provide riparian corridors, bear-foraging buffers, and other wildlife-related buffer areas to maintain connections and remnant patches within the managed landscape.

> **Patch isolation/and connectivity**. The creation of numerous small patches heightens the risk that suitable habitats would become isolated from each other. This problem occurs if the area between patches becomes inhospitable to species movement. Barriers to the movement of species from one suitable habitat patch to another reduce the connectivity of these habitats. When specific vegetation types and cover conditions are present between patches, species can move between them. Major sources of patch isolation that reduce connectivity include highways, construction projects on private land near the Forest, and the development recreation sites on the Forest.
>
> **Patch size**. Many interior forest species seek out conditions that are beyond the influence of edges, and as such they require minimum sizes of habitat. As patches become smaller, they may not meet the needs of the species.
>
> **Edge effects**. As patches become smaller, the result is an increase in the amount of edge. An impact could be increased competition and predation from species that are adapted to edge habitats. Forest vegetation management and road developments are primary factors responsible for increasing the amount of the edge within the Forest.

Among the key sources of fragmentation are the following:

> The **Sterling and Seward Highways**, and private land development along them, are a major impediment to wildlife movement. These roads and urban development along them is a significant barrier to the traditional movement of moose and other species. The consistent traffic along this highway makes it difficult for large and small mammals to cross successfully. These highway

corridors have increased patch isolation and the amount of the edge, and have decreased the connectivity of suitable habitat on both sides of these roads.

Private land development in the vicinity of Moose Pass and Cooper Landing has changed much of the character of the Kenai River valley. Historical bear movement areas and moose winter range has been transformed into residential and commercial properties. This development has affected patch isolation and size, the amount of edge, and connectivity of habitats.

Active management of state and private land on the Chugach, prescribed burning, and active timber harvest, has either perforated or fragmented some portions of the landscape, depending upon the scale of development and the species involved. On the Chugach, these activities have occurred on a limited scale and species generally have suitable adjacent habitats to which they can move. Patch size may be smaller and edge amounts have increased, but for the most part connectivity has not been impaired by active management activities.

Environmental Consequences

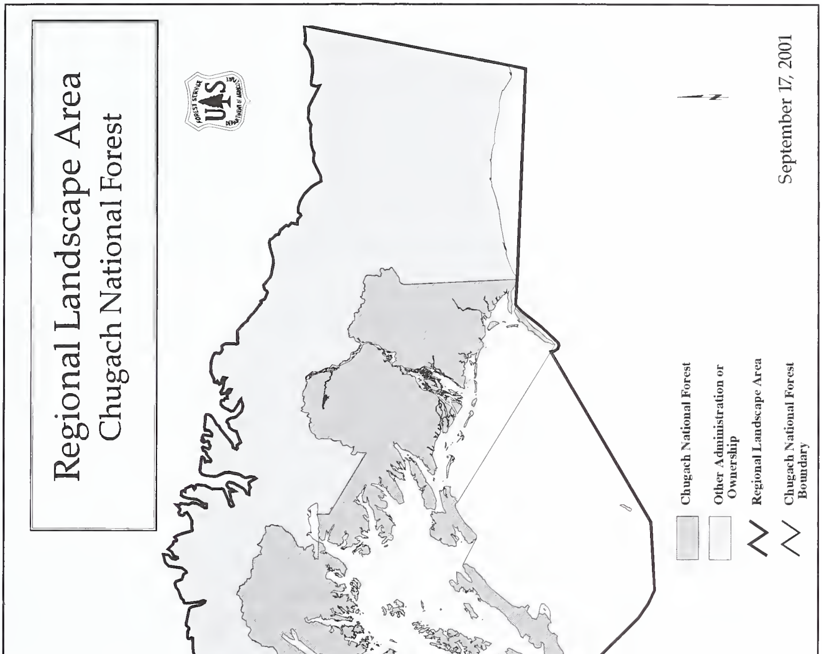
Introduction

Timber harvests and mining activities can modify the structure and composition of native vegetation and reduce diverse natural ecosystems. However on the Chugach National Forest, such ground-disturbing management activities have been limited to a minor component of the landscape. The nature of the Chugach is one of relatively undiminished natural processes and intact ecosystems. Placer mining has altered riparian ecosystems in a few areas on the Kenai Peninsula (e.g., lower portion of Resurrection Creed). Vegetation management activities of the past 30 years have taken place primarily on the Kenai Peninsula, totaling less than 5 percent of the forested area of the Kenai. Approximately half of the area was treated by prescribed burning and half by timber harvest. The more passive management activity of increased recreational use on the Chugach poses a more subtle threat to the native flora and fauna than most active management activities. Overall, at the Forestwide level, there will be no significant effect on biodiversity under any of the alternatives.

Ecoregions of the Chugach National Forest

To better understand how Forest Plan allocation decisions would affect the regional landscape, an analysis was completed at the ecoregion scale. First, a regional landscape analysis area was identified (Figure 3-7b). The area selected was the ecoregion/subsection area developed for Forest Plan revision. This area was large enough for a regional landscape assessment and used boundaries based on ecoregions and subsections basis. This information was also used for biodiversity analysis at the Forest level.

Figure 3-7b: Regional landscape area.



Second, land ownership was identified for the entire regional landscape analysis area (Table 3–23a).

Table 3-23a: Regional landscape ownership.

Owner	Acres
Chugach National Forest	5,491,600
State of Alaska	3,521,400
National Park Service	3,467,400
Bureau of Land Management	1,822,100
Native Corporations	816,900
National Wildlife Refuge	810,200
Private	170,600
Military	20,400
Total	**16,110,800**

Source: State of Alaska, DNR, GIS data layers.

Next, Revised Forest Plan prescription categories were assigned to all lands within the analysis area.

Category 1 – National Parks, Wilderness, Chugach State Park

Category 2 – National Wildlife Refuge, BLM Limited Use, State Wildlife/Limited Use Areas

Category 3 – BLM and State Multiple Use Areas

Category 4 – Native Corporations, Private, Military

For Chugach National Forest lands, prescription categories were used based on the Revised Forest Plan alternatives (see Chapter 2, Alternative Descriptions). Category 5 was not used because at the regional scale these areas were not mapped. Assigning prescription categories throughout the regional landscape assessment area allowed us to analyze how land allocations on the Chugach National Forest would affect the regional landscape. Table 3-23b show these effects, by Forest Plan alternative.

Table 3-23b: Percent regional landscape by prescription category, by alternative.

Category	No Action	Preferred	A	B	C	D	E	F
Category 1	39	44	28	34	37	46	52	56
Category 2	26	36	33	37	42	35	29	25
Category 3	29	14	29	23	14	13	13	13
Category 4	6	6	10	6	7	6	6	6
Category 5	0	0	0	0	0	0	0	0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

At the regional landscape level, Alternatives A, E, and F would have a significant change (greater than ±10 percent) in amount of lands in the preservation category (Category 1). Under Alternative A, there would be 11 percent decrease from the current condition (No Action Alternative), and under Alternatives E and F, there would be 13 and 17 percent increase, respectively. Under the Preferred

Alternative and Alternatives B, C, and D, the change in the amount preservation lands would not be significant (less than ±10 percent).

At the regional landscape level, the Preferred Alternative and Alternatives B and C would have a significant change (greater than ±10 percent) in the lands in the recreation/wildlife category (Category 2). Under the Preferred Alternative and Alternatives B and C there would be a 10, 11, and 16 percent increase, respectively. Under Alternatives A, D and E, the change in the amount of recreation/wildlife lands would not be significant (less than ±10 percent). Under Alternative F, the amount of recreation/wildlife lands would not change (±1 percent).

At the regional landscape level, the Preferred Alternative and Alternatives C, D, E, and F would have a significant change (greater than ±10 percent) in the lands in the actively managed for wildlife/recreation and resource improvement (Category 3). Under the Preferred Alternative and Alternatives C, D, E, and F there would be a 15, 15, 16, 16, and 16 percent decrease from the current condition (No Action Alternative), respectively. Under Alternative B, the change in the amount of actively managed for recreation/wildlife and resource improvement would not be significant (less than ±10 percent). Under Alternative A, the amount of lands actively managed for wildlife/recreation and resource improvement would not change (±1 percent).

At the regional landscape level only Alternative A would have some change in the lands in that may be used for resource development (Category 4). Under Alternative A there would be 3 percent increase from the current condition (No Action Alternative). This change would not be significant (less than 10 percent). Under the Preferred Alternative and Alternatives B, C, D, E, and F, the resource development lands would not change (±1 percent).

Collectively, at the regional landscape level only Alternative A would have more development (Category 3 and 4 lands) than the current condition (No Action Alternative). Alternative B would have somewhat less development than the current condition, but it would be higher than other alternatives. The Preferred Alternative and Alternatives C, D, E, and F would reduce the lands available for resource development by about 15 percent over the current condition. There are little real differences between these alternatives because they all retain about 80 percent of the lands in a preservation or limited use category.

This analysis was done at a large scale and there were some shortcomings in the available data. For example, Congress would have to act on Chugach National Forest Wilderness and Wild and Scenic River recommendations before these areas are actually protected by law. Most state and BLM lands were not stratified into different categories, so agency planners had to make their best estimates. In addition, not all native corporation and private lands would be used for resource development. Likewise, not all Chugach National Forest lands allocated for resource development would be developed. However, all these lands are available for resource development. Even with these shortcomings, this analysis allows us to identify land allocation decisions that would significantly

affect the regional landscape. However, the degree with which they would be affected by resource development most likely would be far less than projected.

Habitat Diversity

Land Cover

Figure 3-8a presents the proportion of each land cover class in each prescription category by alternative for the entire Forest (including ANILCA additions).

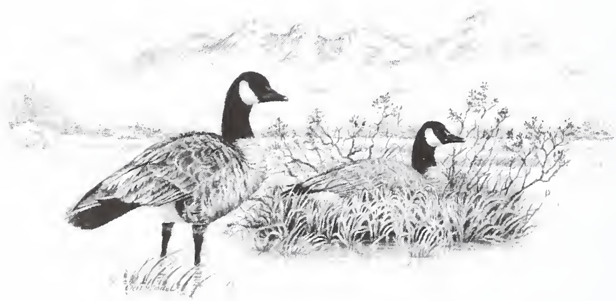


Figure 3-8a: Proportion of land cover class by prescription category by alternative.

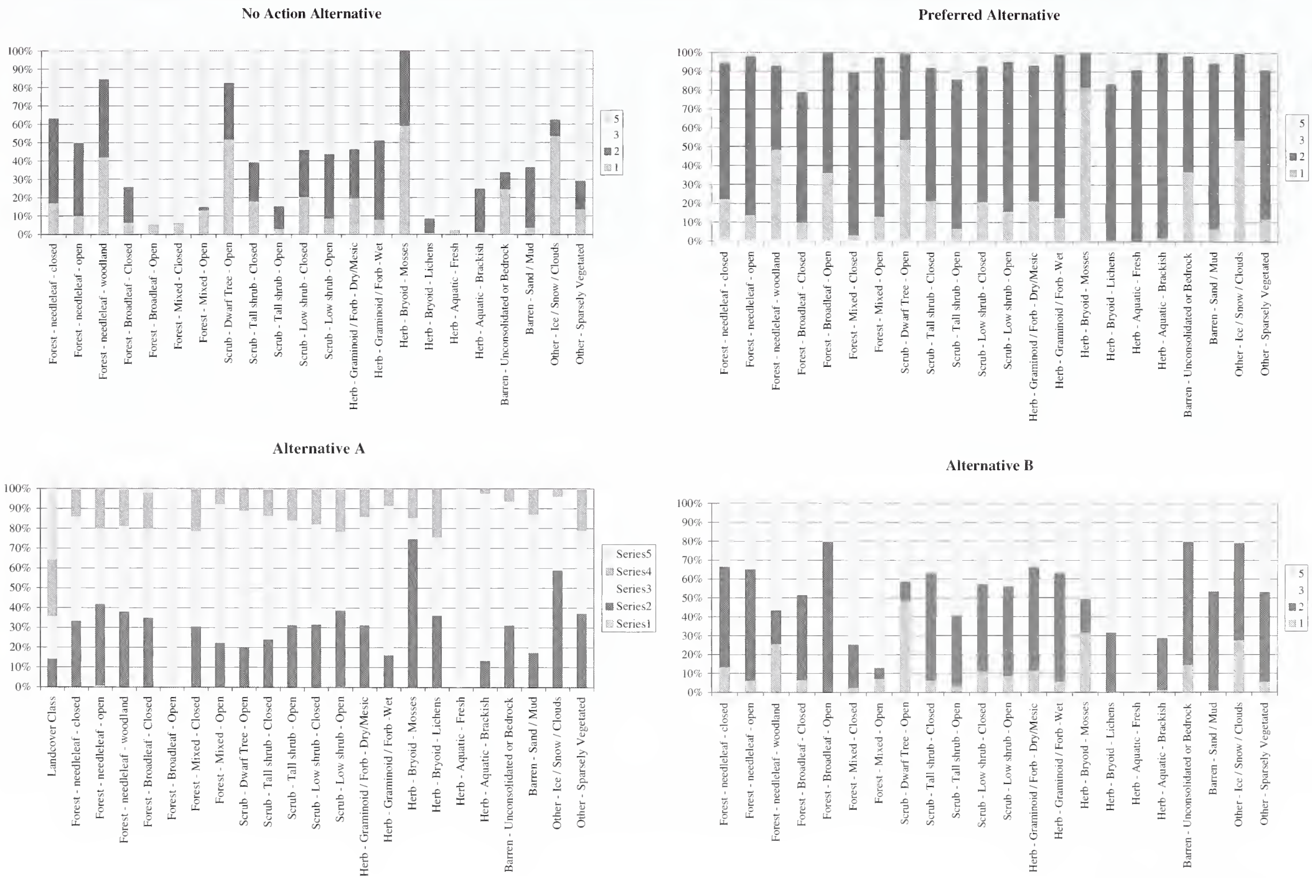
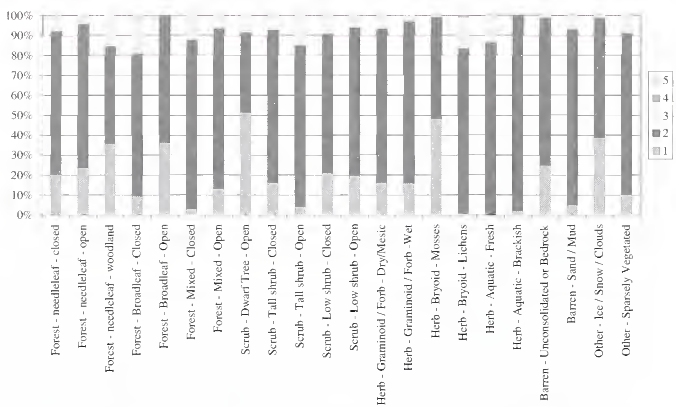
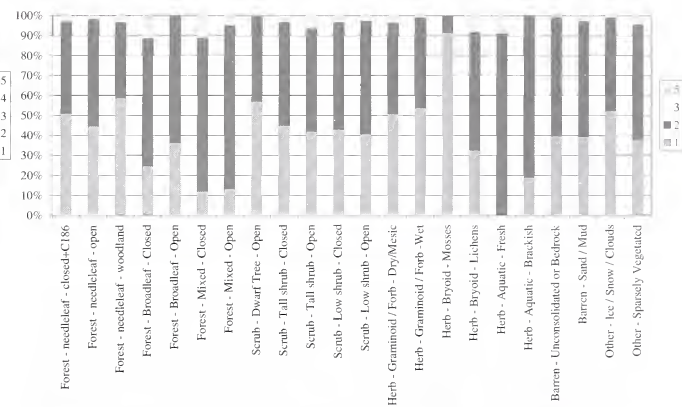


Figure 3-8a (continued): Proportion of land cover class by prescription category by alternative.

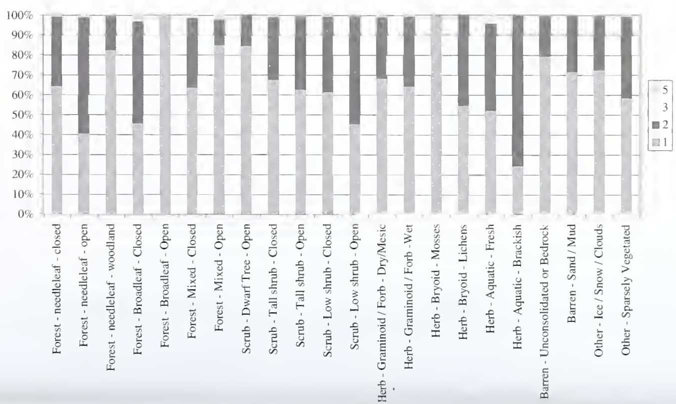
Alternative C



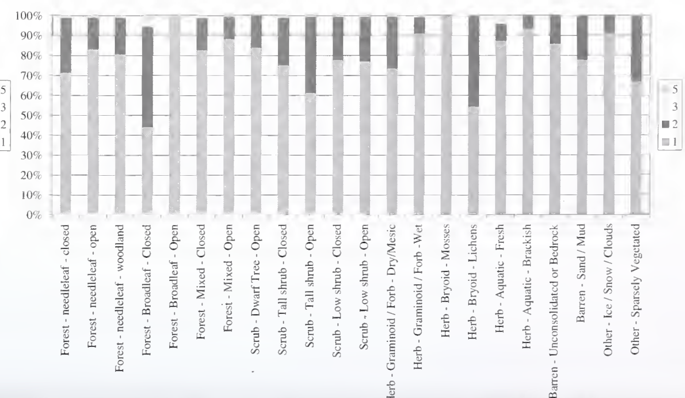
Alternative D



Alternative E



Alternative F



Vegetative Cover

Figure 3-8b displays the proportion of land cover types of the Chugach (not including the ANILCA additions) by prescription category (1-5) for each alternative. Figure 3-8c illustrates the forest structural classes Forestwide (not including ANILCA additions) by prescription category and alternative. The greatest amount of ground-disturbing activity and associated potential for adverse impacts on biological diversity is in Category 4 and 5 prescriptions (although the threat is low in these prescriptions due to the variety of laws and regulations which protect and provide for intact ecosystems on federal lands). While Category 3 prescriptions apply a relatively soft touch on the land, some ground-disturbing activities are allowed. Category 1 and 2 prescriptions afford the highest protection of intact natural ecosystems (but may restrict management options for ecosystem restoration). However, many Category 1 and 2 prescriptions may serve to promote increased recreational activities on the Forest, causing threats to populations susceptible to increased human presence. The proportion of Category 5 prescriptions does not vary between alternatives.

The No Action Alternative includes most vegetation cover classes in Category 3 prescriptions, with significant proportions in Category 1 and 2 prescriptions. The greatest proportions of hemlock, hemlock-spruce, and Sitka spruce occur in Category 2 prescriptions. Most deciduous forest, mixed hardwood-softwood, and white spruce stands are in Category 3 prescriptions, which allows for active management in order to maintain early successional habitat and accelerate forest succession in areas of high bark beetle spruce mortality. The majority of the snow and ice cover class is in Category 1 prescriptions.

The Preferred Alternative includes almost all cover types in Category 2 prescriptions, with significant proportions of many cover classes (particularly hemlock and hemlock-spruce) also in Category 1 prescriptions. The relatively limited vegetation classes of birch and black spruce (occurring almost exclusively on the Kenai Peninsula) are primarily in Category 3 prescriptions. Significant proportions of aspen, mixed hardwood-softwood, and white spruce forests are in Category 3 prescriptions, allowing for active management in those stands in order to maintain early successional habitat and accelerate forest succession in areas of high bark beetle spruce mortality.

Alternative A includes the majority of all cover classes in Category 3 prescriptions, with the exception of snow and ice and rock classes, the bulk of which are included in Category 2 prescriptions. Significant proportions of hemlock and hemlock-spruce also occur in Category 2 prescriptions. Active management is allowed in most stands in all cover types. Alternative A allows for the greatest amount of ground-disturbing activities and motorized recreation.

Alternative B consists primarily of an almost equal proportion of Category 2 and 3 prescriptions. Sitka spruce, hemlock, and hemlock-spruce stands occur primarily in Category 2 prescriptions, while deciduous, mixed hardwood-softwood, and white spruce stands occur primarily in Category 3 prescriptions (allowing for active management of deciduous stands and bark beetle impacted spruce stands). Significant proportions of hemlock and hemlock-spruce also occur in

Category 1 and 3 prescriptions, while a significant proportion of mixed hardwood-softwood forest also occurs in Category 2 prescriptions.

Alternative C consists primarily of Category 2 prescriptions, with a lesser amount in Category 1. The most cover classes are in Category 2 prescriptions. Slightly more birch and black spruce stands are in Category 3 rather than Category 2 prescriptions. Significant proportions of hemlock and hemlock-spruce cover classes are also in Category 1 prescriptions. Significant proportions of aspen, mixed hardwood-softwood, and white spruce also occur in Category 3 prescriptions (primarily on the Kenai Peninsula), allowing for active management of deciduous forests and restoration of spruce forests with high levels of bark beetle induced mortality.

Alternative D includes almost equal proportions of Category 1 and 2 prescriptions. The majority of cover classes occur in Category 2 prescriptions, with slightly more birch and black spruce in Category 3 rather than Category 2 prescriptions. Aspen, hemlock-spruce, and Sitka spruce are primarily in Category 1 prescriptions. Significant proportions of aspen also occur in Category 2 and 3 prescriptions. Significant proportions of hemlock and white spruce also occur in Category 1 prescriptions. Those areas of aspen and birch occurring in Category 3 prescriptions would allow for active management in necessary to maintain such early successional deciduous stands. Active management would not be an option for the majority of mixed hardwood-softwoods and white spruce in Categories 1 and 2 prescriptions. The mixed stands would continue to become more dominated by conifers, while the white spruce stands impacted by the bark beetle would become reforested at a slower rate than if actively managed.

Alternative E includes the majority of all cover classes except birch in Category 1 prescriptions. The majority of birch is in Category 2 prescriptions. Significant proportions of all cover classes also occur in Category 2 prescriptions. Minimal amounts of most cover classes occur in Category 3 prescriptions. Alternative E would allow for minimal active management of the Chugach National Forest.

Alternative F includes the greatest proportion of all cover classes in Category 1 prescriptions. Most of the relatively restricted black spruce cover class occurs in Category 2 prescriptions. All the remaining cover classes occur predominantly in Category 1 prescriptions, with significant proportions of each also in Category 2 prescriptions (but less than in Alternative E). Small proportions of aspen, birch, and mixed hardwood-softwoods occur in Category 3 prescriptions would allow for limited active management of forest conditions on the Kenai Peninsula.

Forest Structure

The distribution of the different forest structure classes within prescription categories also varies by alternatives (Figure 3-8c). The majority of young mature and old mature size classes are in Category 1 or 2 prescriptions in all alternatives, except Alternative A. Most poletimber and seedling/sapling size class acreages are in Category 3 prescriptions in the No Action Alternative and Alternatives A and B. Poletimber and seedling/sapling size class acreages are

predominantly in Category 2 prescriptions in the Preferred Alternative and Alternatives C and D. Alternatives E and F have most poletimber and seedling/sapling (as well as young and old mature) size classes in Category 1 prescriptions.

Figure 3-8b: Proportions of vegetative cover types by prescription category, by alternative (does not include ANILCA additions).

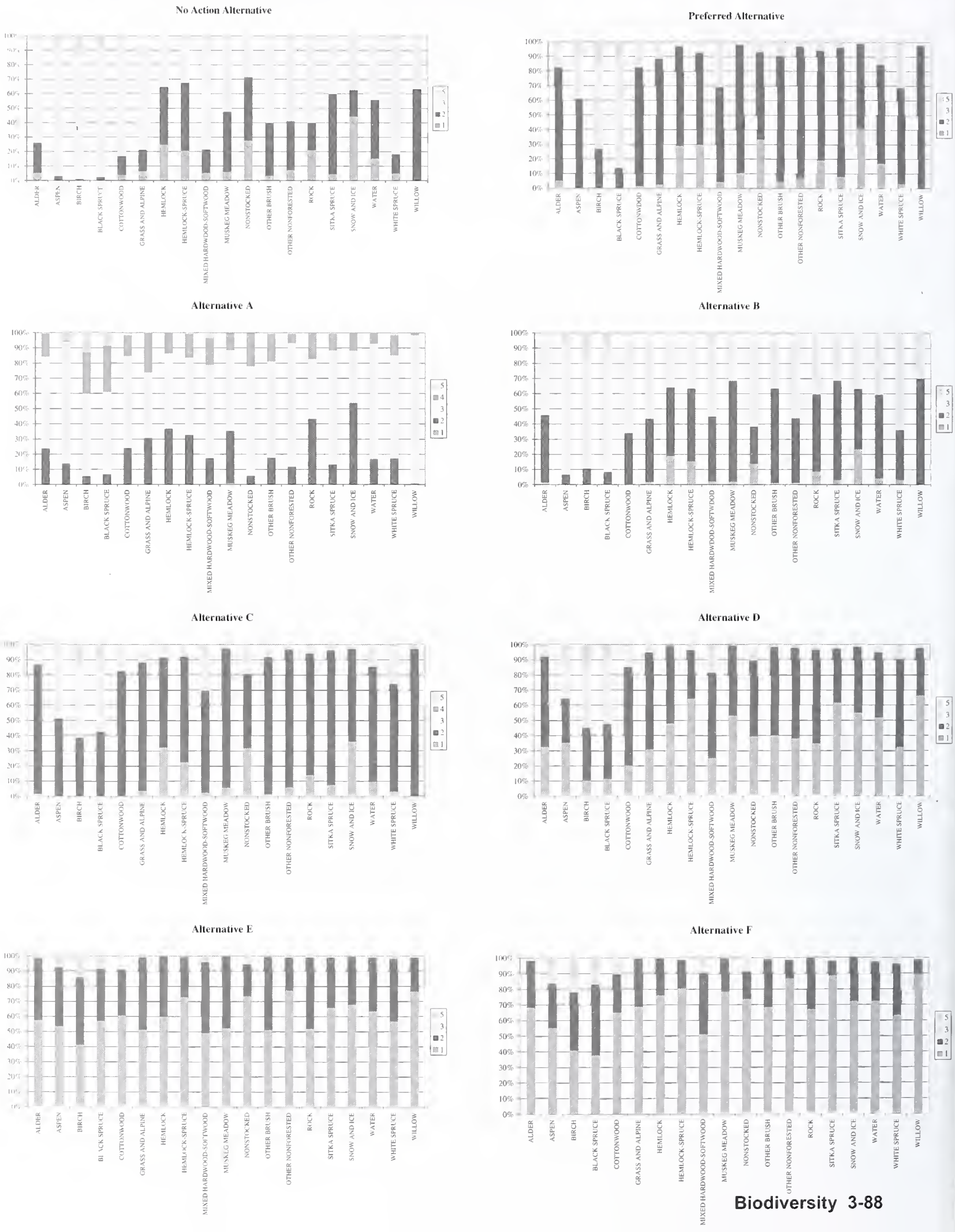
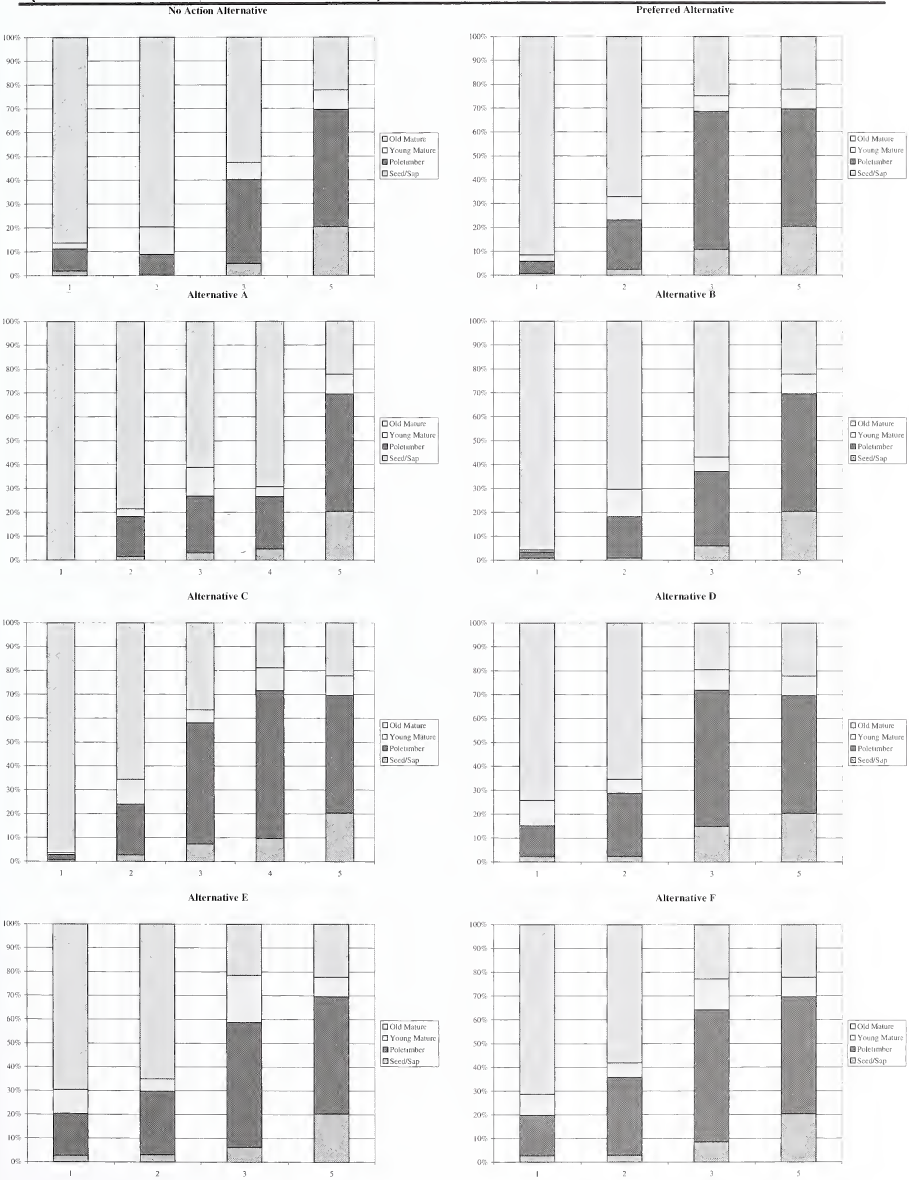


Figure 3-8c: Proportion of forest structural classes by alternative, all forest types (does not include ANILCA additions).



Habitat Diversity Model

The bioenvironmental classification of the Chugach National Forest serves as a measure of habitat diversity across the Forest. These classes can be grouped according to prescription category, with Category 1 and 2 prescriptions corresponding roughly to the "protected" status of Duffy and others (1999) (status 1 and 2 of Duffy et al. (1999)). The more active management area prescriptions Categories 3, 4, and 5 offer "moderate" levels of protection to ecosystem processes and the diversity of native species (protection status 3 of Duffy et al. 1999).

At the coarse filter level, 12 percent was considered to be a minimal representative amount of each bioenvironmental domain, based on works by Duffy and others (1999) (Conservation of Arctic Flora and Fauna 1994, World Commission on Environment and Development 1987). The Commission arrived at 12 percent by suggesting that the amount of land in reserves needed to be at least tripled to achieve a representative sample of biological diversity. In 1987, when the Commission report was published, approximately 4 percent of the world was in reserves. In the present analysis, 12 percent is used for comparisons, although it may be too low to be a valid target for representation. The proportion of the total area needed for representation of all the features of a region can be large. Estimates vary from 8 percent (Pressey and Nicholls 1989) to 45 percent (Margules et al. 1988) depending on the scale of definition of the features and the size of the area being examined (Bedward et al. 1992). Numerous factors influence the percentage of a region needed in reserves to meet conservation goals. These are listed and described in Noss and Cooperrider (1994), and include such factors as habitat heterogeneity, area requirements of the species present, scales of natural disturbance, and the degree of connectivity among habitat patches.

No Action Alternative: 65 percent of bioenvironmental classes protected at 12 percent or greater level (75 classes out of 217 with less than 12 percent of the area in Category 1 or 2 prescriptions). Total area of bioenvironmental classes with less than 12 percent area in Category 1 or 2 prescriptions is 855,134 acres.

Preferred Alternative: 99 percent of bioenvironmental classes protected at 12 percent greater level (3 classes out of 217 with less than 12 percent of the area in Category 1 or 2 prescriptions). Total area of bioenvironmental classes with less than 12 percent in Category 1 or 2 prescriptions is 458 acres.

Alternative A: 41 percent of bioenvironmental classes protected at 12 percent or greater level (127 classes out of 217 with less than 12 percent of the area in Category 1 or 2 prescriptions). Total area of bioenvironmental classes with less than 12 percent of the area in Category 1 or 2 prescriptions is 665,190 acres.

Alternative B: 85 percent of bioenvironmental classes protected at 12 percent or greater level (32 classes out of 217 with less than 12 percent of the area in Category 1 or 2 prescriptions). Total area of bioenvironmental classes with less than 12 percent in Category 1 or 2 prescriptions is 28,613 acres.

Alternatives C, D and E: 98 percent of bioenvironmental classes protected at 12 percent or greater level (4 classes out of 217 with less than 12 percent of the area in Category 1 or 2 prescriptions). Total area of bioenvironmental classes with less than 12 percent in Category 1 or 2 prescriptions is 500 acres.

Alternative F: 99 percent of bioenvironmental classes protected at 12 percent or greater level (2 classes out of 217 with less than 12 percent area in Category 1 or 2 prescriptions). Total area of bioenvironmental classes with less than 12 percent in Category 1 or 2 prescriptions is 42 acres.

Figure 3-9a displays the proportion of all bioenvironmental classes with at least 12 percent of the area in Category 1 or 2 prescriptions versus those with less than 12 percent. Figure 3-9b displays area by prescription category for those bioenvironmental types with less than the minimum 12 percent in Category 1 or 2 prescriptions. One needs to remember, biodiversity would not be affected just because lands are allocated to Category 3, 4 or 5 prescriptions. Any effects would be spaced over time as disturbance activities permitted by the management area prescriptions are implemented.

Figure 3-9a: Bioenvironmental classes with at least 12 percent of area in Category 1 or 2 prescriptions by alternative.

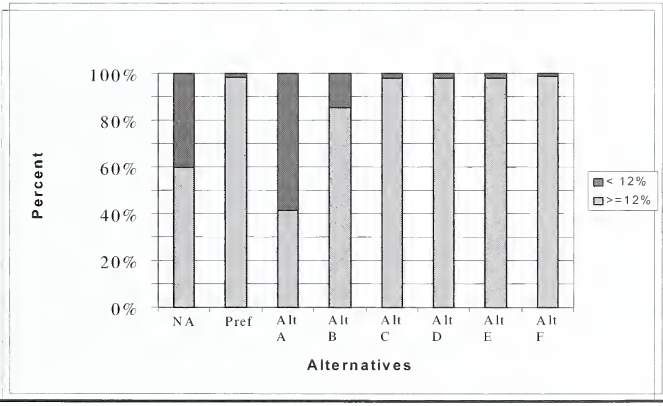
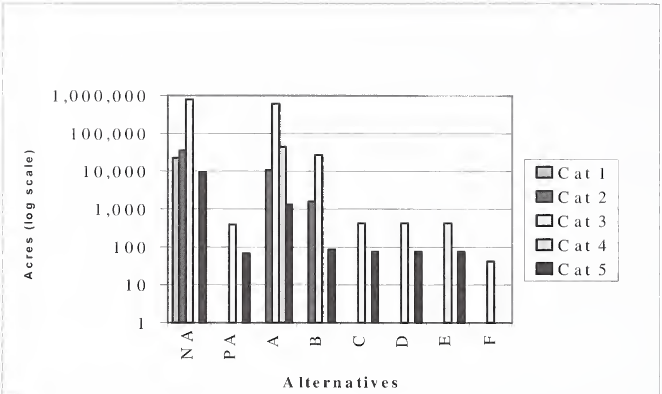


Figure 3-9b: Area of bioenvironmental classes with less than 12 percent of area in Category 1 or 2 prescriptions by alternative.



Expected Range of Variability (ERV)

General effects

Most changes to vegetation in these areas would result from natural disturbances alone, which generally would result in maintaining ERV conditions. Where active management is prescribed, changes in vegetation would occur at a site-specific scale. Most of the active management is proposed to occur on the Kenai Peninsula portion of the Forest. This is also the area where bark beetles have been most active, and where the present-day vegetation has been widely affected by human-caused disturbance (primarily burning, logging, and mining) within the last 100 years. However, as was pointed out earlier, over the 10-year life of the Revised Forest Plan, a total of about 36,000 acres of vegetation treatment would occur under the Preferred Alternative. This acreage represents less than 5 percent of the vegetated land on the National Forest portion of the Kenai Peninsula, and less than one percent of the entire area of the Forest. It is logical to infer that the magnitude of the ERV greatly exceeds the magnitude of proposed vegetation treatments under the Preferred Alternative, i.e., the proposed treatments are within the ERV, even on the Kenai Peninsula.

- The No Action Alternative emphasizes a mix of active management and natural processes with which to sustain ecological systems. Active management for the conservation of fish and wildlife habitats and active reforestation of spruce beetle infested stands on the Kenai Peninsula is emphasized.
- The Preferred Alternative stresses natural processes within the Copper River and Prince William Sound geographic areas, while

allowing some active management and/or resource development in selected areas, such as on the Kenai Peninsula. Active management is allowed in order to maintain ERV parameters such as the existing early successional conditions and to accelerate reforestation within areas of high bark beetle spruce mortality. Although tree regeneration is projected to occur within bark beetle affected areas (DeLapp et al. 2000) active reforestation may be desirable to accelerate the regeneration process.

- Alternative A emphasizes active management throughout the forest to sustain ecological systems. The reforestation of spruce beetle infested stands on the Kenai Peninsula receives particular emphasis.
- Alternative B provides for active management throughout most of the Forest in order to sustain ecological systems. The conservation of fish and wildlife habitats and active reforestation of spruce beetle infested stands on the Kenai Peninsula is emphasized.
- Alternative C emphasizes a mix of active management and natural processes throughout the Forest to sustain ecological systems. The conservation of fish and wildlife habitats and active reforestation of spruce beetle infested stands on the Kenai Peninsula is emphasized.
- Alternative D stresses natural processes over most of the Chugach National Forest, with limited active management primarily in areas adjacent to roads and in areas on the Kenai Peninsula and Copper River Delta for fish and wildlife projects, recreation facility development, and for personal uses.
- Alternative E emphasizes natural processes throughout the Forest, stressing the preservation of intact ecosystems through passive management. Reforestation activities would be restricted to the Kenai Peninsula highway corridor or around local communities, and would be limited to the salvage of dead trees.
- Alternative F emphasizes natural processes throughout the Forest to sustain ecological systems, stressing the preservation of intact ecosystems and integrity of roadless areas across the Forest. Active management activities are limited over the broadest area of the Forest. Reforestation of spruce beetle infested stands on the Kenai Peninsula would be allowed within the highway corridor and around local communities, but would be limited to the salvage of dead trees. Limited fuel reduction and wildlife enhancement projects would be allowed in the vicinity of Kenai Peninsula communities.

Effects on the ERV from utility corridors
The effects of utility corridors would be minimal on the biological and habitat diversity of the Chugach, being of very limited extent on the Forest.

Effects on the ERV from mineral exploration and extraction (leasable)
Localized modification of vegetation structure and composition would result from the construction and maintenance of roads and well pads during development and extraction, but impacts would not be significant in any alternative.

Effects on the ERV from mineral exploration and extraction (locatable)
Development of access roads and ground-disturbing mineral exploration may affect some forest stands. The potential for intensive development of locatable minerals is considered to be low for all alternatives. The greatest number of acres of mineral withdrawal occurs in Alternative F. Alternative A has the fewest acres withdrawn. No significant changes to ERV characteristics are expected in any alternative.

Effects on the ERV from recreation management
The construction of new trails may promote the introduction of noxious weeds and non-native vegetation. The greatest impacts would be in Alternatives C, B, D, the Preferred Alternative, and Alternative A, with the greatest amount of new trail construction. Alternative F would have the least potential for impacts, with the least amount of new trail construction. The No Action Alternative and Alternative E would both have moderate greater impacts with slightly more trail construction.

Effects on the ERV from timber management
The limited nature of proposed timber management in all alternatives would minimally affect the ERV through the creation of increased proportions of early seral vegetation and possible increased presence of noxious weeds in certain alternatives. Alternative A promotes the highest levels of active management and early successional forests. Alternatives A and B and the No Action Alternative all incorporate timber harvest to maintain the ERV of early seral conditions. The Preferred Alternative and Alternatives C, D, E, and F all stress the need for maintaining or enhancing ERV old growth conditions, maintaining early successional conditions through natural disturbance regimes.

Effects on the ERV from access management
Impacts to vegetation from travel management would result from habitat alterations during the construction and maintenance of roads and trails. Alternatives A (11.4 miles) and B (10 miles) result in the most miles of annual road construction, followed by the No Action Alternative. The Preferred Alternative and Alternatives C, D, E, and F have the fewest new miles (ranging from 3.3 to 1.3 per year). The overall impacts to forestwide ERV vegetation conditions are minimal due to the small acreages involved.

Effects on the ERV from fire management
Prescribed fire would be used to achieve fuels management and wildlife management goals on the Kenai Peninsula in all alternatives. Fuels treatments in forested and non-forested areas are projected for all alternatives. Fire

suppression efforts would be similar in all alternatives and would concentrate on protection of private lands and high-value resources. Impacts to ERV conditions from fire management are expected to increase early successional conditions and the extent of hardwood stands on the Kenai Peninsula. The Preferred and No Action Alternatives and Alternatives A, B and C all have approximately 2,650 acres of annual prescribed burning projected for the Kenai Peninsula. Alternative D has approximately 1,950 acres, while Alternatives F and E have the least at approximately 1,300 acres per year.

Fire management activities would preserve the expected range of variability under current climatic conditions for the results of fire. The Kenai Peninsula has historically been the most subject to wildfires of any area in the Chugach National Forest and neither the magnitude nor frequency of wildfires is anticipated to exceed those that occurred historically. The prescribed fire regime, even with happenstance wildfires, would not change the vegetative pattern beyond that in the historical record. Prescribed fire and mechanical treatments to convert vegetation to an earlier seral stage will affect, at most, 36,000 acres of the total 773,499 acres of land to which such treatments could be applied, or less than 5 percent. Large wildfires coupled with the prescribed fire regime likely would recreate conditions similar to those following the large wildfires on the Kenai prior to the 1930s. The resulting vegetation increased winter habitat for moose and other early- to mid- successional dependent wildlife species, such as snowshoe hares and their predators. Fire suppression activities would tend to restore conditions over time to those currently extant. Effects on late successional wildlife species would be no different than during the middle to late 1900s. As succession advanced, such species would either increase in numbers or recolonize the Kenai Peninsula from other areas of the Chugach National Forest that have not been affected by wildfires.

Fragmentation and Perforation

General effects

In general, the more human activities occur in an area, the greater the likelihood that habitats would become fragmented or perforated. Timber management, road and trail construction and reconstruction, mineral exploration and extraction, development, development of utility corridors, and developed recreation sites all have the potential to increase fragmentation and perforation.

Areas recommended for Wilderness designation or which are included in management areas that focus on limited active management would reduce the risk for fragmentation and perforation. Forest restoration and wildlife habitat improvement projects may include projects that could result in some level of fragmentation or perforation depending upon the habitat management techniques selected. Some level of natural fragmentation, including perforation, may result depending upon the type and extent of disturbance, the amount of adjacent suitable habitat remaining after the disturbance, and the species involved.

In areas of the Forest where management activities would be promoted, impacts to patch isolation, patch size, and edges, would continue. The vegetation

management activities may produce temporary perforations of habitat that would last from a few years to a few decades until regeneration stands meets identified habitat needs. In developed recreation sites such as campgrounds, fragmentation would result in a number of long-term changes to the landscape, including vegetation type conversions.

Effects on fragmentation and perforation from transportation/utility corridors

The development of transportation/utility corridors is expected to be similar in all alternatives. These linear developments are narrow bands of activities that generally are managed to maintain early seral vegetation. The corridors may slightly affect movement of some animals but no species have been identified for which these types of activities create total barriers to movement. They may make some species more vulnerable to predation as they move from one side of the corridor to the other.

Effects on fragmentation and perforation from mineral exploration and extraction (leasable)

Impacts would result from the construction and maintenance of roads and well pads during exploration, development, and extraction. This development would perforate habitats for more species during the development phase of activities. This development would result in smaller patch sizes and more edge in the developed areas, which may perforate some habitats for less mobile species. These areas are expected to be restricted in size.

The potential effects from a single exploration well would not vary by alternative. The acres available for leasing do vary by alternative: Alternatives D, E and F offer the least number of acres available, followed in order of increasing availability by the Preferred, the No Action, A, B, and C.

Effects on fragmentation and perforation from mineral exploration and extraction (locatable)

Development of access roads and ground-disturbing mineral exploration may affect some forest stands. The potential of intensive development of locatable minerals is considered to be low in all alternatives. The greatest number of acres of mineral withdrawal occurs in Alternative F, followed in declining amounts by E, D, the Preferred, No Action, B, and A.

Effects from recreation management on fragmentation and perforation

The construction and reconstruction of trails to meet recreation goals may affect some species. The least impact would be associated with Alternative F, which has the fewest miles of new trail construction and reconstruction, followed in order of increasing impacts by the No Action Alternative, Alternatives E and A, the Preferred Alternative, and Alternatives D, B and C, which all have over 20 miles of new trail construction or reconstruction per year. Alternative C may have the most effect with nearly 28 miles of trail construction per year. There is little or no information available regarding differences in impacts in fragmentation between motorized and nonmotorized trail use. Generally, wildlife species are able to move through areas with trails with little problem. The Chugach has not

identified the species for which trails would be considered a significant fragmented effect.

Effects on fragmentation and perforation from timber management
The fragmentation and perforation effects from timber management in forested ecosystems are discussed in more depth in the vegetation section of this chapter. Timber management and the associated facilities may perforate habitats. These effects may have positive impacts to species favoring early seral conditions and negative impacts to species favoring late-successional forests. These effects are short term and habitats would change as the managed stands age and progress through natural succession. Most species should be able to negotiate around or through the actual cutting units to suitable adjacent habitats; therefore these impacts would be perforation rather than fragmentation. The structural stages changes associated with even-aged timber management results have the most potential to perforate habitats.

The Preferred Alternative and Alternatives C, D, E, and F focus on uneven-aged management where less than 500 acres of timber could be harvested annually. Alternative B and the No Action Alternative would harvest approximately 1,000 acres of timber per year. The maximum effects would come under Alternative A, where 1,530 acres would be harvested.

Effects on fragmentation and perforation from access management
The construction and reconstruction of roads and trails to meet travel management goals would result in impacts to a variety of species. Two aspects of these activities would have the potential to affect wildlife species. First, the actual construction of the road would result in direct habitat loss for certain species. Second would be the indirect impacts associated with the human use of roads and trails after they are built. These impacts often are more significant in the long term. Restricting or prohibiting motorized use on roads can often greatly reduce the effects of the road to most wildlife species. The total miles of open roads and trails are the best measure of the effects of travel management on fragmentation/perforation. Roads may positively affect some animals (except for slow-moving individuals), but the majority of species show some level of aversion to roads opened for authorized use. No species on the Chugach has been identified for which roads would serve as a total movement barrier, but many species seek habitats away from actively used roads.

Total miles of available system roads is expected to increase in Alternatives A and B, and decrease from the existing situation in the Preferred Alternative and Alternatives C, D, E, and F in declining order.

Effects on fragmentation and perforation from fire management
Fire has always been a natural part on the Kenai Peninsula portion of the Chugach landscape. The use of prescribed fire to treat fuels or enhance wildlife habitats would result in early seral vegetation, usually in a mosaic of vegetation designed to resemble natural patterns. Some animals may find these treatment areas to be perforated. But due to the relatively small size of treatment areas and the resultant mosaic pattern, they normally would be able to move through or

around the burned areas to suitable adjacent areas. These treatments would not serve as fragmentation barriers to any identified species in all alternatives.

There is a total of 400 acres per year of this treatment in all alternatives (not including wildlife burns).

Composition

General

Whenever land management changes the extent and duration of a disturbance beyond the natural limits of the evolved disturbance regime, ecosystem composition, structure, and function can be adversely affected. Suppressed disturbances can lead to communities dominated by a few superior competitors, while extreme disturbance can lead to communities where only a few tolerant species can survive (Noss and Cooperrider 1994).

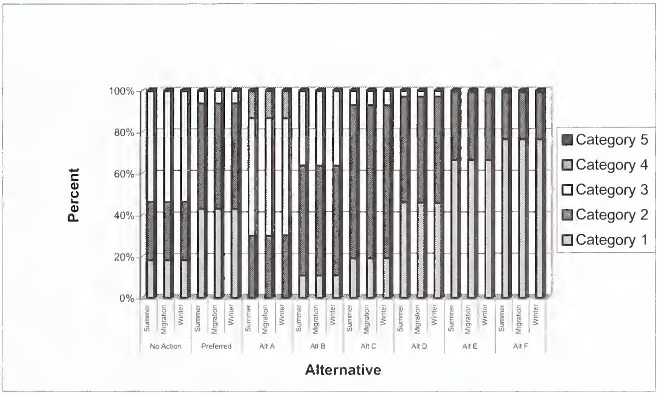
Disturbance is common in boreal forests such as that found on the Kenai Peninsula. In fact, these forests have been referred to as a “disturbance forest” because of the overall nature of fire (Rowe 1961). Fires and insect epidemics are both major disturbance processes. Spruce beetles have killed white spruce across much of its range on the Chugach.

The composition of the Forest and the associated wildlife communities in the boreal forest is dependent upon the variation in the landscape due to these disturbances and others (Agee 1999). Both disturbance processes may cause significant variation in the seral conditions present depending on the intensity and scale of the disturbances. There is significant evidence of large stand replacement fires on the Kenai Peninsula over the past 200 years. If fire is suppressed on the Kenai, biodiversity associated with the early seral needleleaf and broadleaf forests would decline and there would be an increase in late seral forest communities. Maintaining a fire-dependent ecosystem through application of a vegetation management or prescribed fire management scheme would help maintain the composition of habitat patches and seral conditions within the ERV.

Direct and Indirect effects

The affect of each alternative on the species richness of the forest was determined by defining how the categories of land management area prescriptions might address species richness over three seasons - summer, fall migration, and winter. Figure 3-10 portrays the distribution of species richness by management area prescriptions for the three seasons.

Figure 3-10: Comparison of species richness for summer, migration, and winter by alternative.



All alternatives would provide habitat to maintain at least 30 percent of the species richness in Category 1 or 2 management area prescriptions. Alternative A provides the least amount of Category 1 and 2 prescriptions, followed by the No Action Alternative, Alternative B, Alternative C, the Preferred Alternative, and Alternatives D, F and E with the greatest amounts of Category 1 prescriptions.

Abundance and Ecological Diversity. Abundance of Forest land cover classes and habitats of special interest communities and ecosystems refers to the total acreage of Forest that meets structural, or functional criteria, based on ecological conditions. Ecological diversity is also indicated by the distribution of communities on the landscape, and the interrelationships among the variety of geographic, climatic, elevational, topographic, and soil distributions.

Four possible outcomes that characterize different levels of abundance and ecological diversity of the land cover classes and habitats of special interest communities and ecosystems were used to represent the possible outcomes from each alternative.

Outcome #1. Land cover classes and habitats of special interest are equal to or greater than the long-term (100-year) average, and are well-distributed across environmental gradients, geographic areas, and vegetation community types.

Outcome #2. Land cover classes and habitats of special interest are somewhat less than the long-term average in some geographic areas and forest types. There is representation of all major forest types but with under representation in some types (may be within range of variability).

Outcome #3. Land cover classes and habitats of special interest are below the long-term average in most forest types. Examples of a few old-growth types are eliminated.

Outcome #4. Land cover classes and habitats of special interest are well below the long-term average in all geographic areas. Examples of several old-growth types eliminated in some geographic areas.

At the Forest level, all alternatives appear to maintain land cover classes and habitats of special interest in amounts necessary to maintain viable populations well-distributed. As Duffy and others (1999) point out using coarse filter surrogates may not adequately represent the location and range of biologically important sites. For example, although a large portion of an ecoregion or the Forest may be within some type of protected status that does not ensure the range of biodiversity in that Forest is also in a protected status. The distribution of many of the species may reflect ecological conditions operating at a smaller scale. To account for biological structure or composition occurring at a smaller scale, analysis was also done to consider if any of the geographic areas would not be represented with at least 12 percent in Category 1 and 2 prescriptions.

Only the No Action Alternative does not have at least 12 percent in Category 1 or 2 prescriptions on the Kenai Peninsula. All alternatives but the No Action provide at least 12 percent of the land cover classes and habitats of special interest in amounts above 12 percent. The No Action Alternative meets this level for Prince William Sound and the Copper River Delta, but does not have at least 12 percent in Category 1 or 2 prescriptions on the Kenai Peninsula. In the No Action Alternative, most of the Kenai Peninsula would be managed for fish, wildlife, and recreation priorities.

The relative change in vegetation structure due to management activities proposed for action was also considered for short-term and long-term effects. The change in total structural stages resulting from all activities would be relatively small in all alternatives, ranging from a maximum of 3.9 percent in the first decade for Alternative A to 1.6 percent in Alternatives E and F.

Listed in order of total structural change, the alternatives are: A, No Action, B, C, Preferred, D, E and F. Changes in structural stages from timber harvest would be limited to four watershed associations. One each on the Kenai Peninsula and in Prince William Sound and two on the Copper River Delta. Under favorable market conditions, the amount of old growth remaining in those watershed associations would exceed 85 percent in the No Action Alternative and Alternative B. McKinley Lake (54 percent), Martin River NW (75 percent), and Snow River (84 percent) would be below the 85 percent level after the first decade.

The ability to use management activities such as timber harvest, forest restoration, and prescribed fire and other mechanical treatments to create mosaics of early seral conditions to meet other objectives was also considered. All alternatives provide some opportunity to maintain early seral conditions with prescribed fire and to use active management.

Overall, it appears that Outcome #1 (land cover classes and habitats of special interest) are equal to or greater than the long-term (100-year) average, and are well-distributed across environmental gradients, geographic areas, and vegetation community types) best describes all alternatives.

Process and Function. Processes refer to the ecological changes or actions that lead to the development and maintenance of forest and non-forest ecosystems at all spatial and temporal scales. Examples include: (1) tree establishment, maturation, and death, (2) gap formation and filling, (3) understory development, (4) small- and large- scale disturbances such as landslides and wind, (5) decomposition, (6) nitrogen fixation, (7) canopy interception of energy and matter, and (8) energy and matter transfers between the forest and atmosphere.

Functions, as used in this analysis, refer to ecological values of the various ecosystems or their components that maintain or contribute to the maintenance of populations of species that used these ecosystems, and that contribute to the diversity and productivity of other ecosystems. Examples of ecosystem functions include: (1) habitat for organisms, (2) climatic buffering, (3) soil development, and (4) the maintenance of soil productivity through inputs of coarse woody debris, nitrogen fixation, spread of biotic and abiotic disturbance through landscapes, and nutrient cycles (production, storage, utilization, and decomposition).

The scale of proposed management activities across the Forest is very small; between 1.6 and 3.9 percent of the forest structural stages would change due to management activities such as timber harvest, prescribed fire, soil and water habitat restoration, developed recreation construction and the associated road construction.

Connectivity across the landscape has been fragmented and perforated from past actions. Proposed activities under all alternatives would provide for strong connections within the islands in Prince William Sound and on the Copper River Delta. Connectivity of forested ecosystems on the Kenai Peninsula is moderate due to moderate distances between old-growth areas. Timber harvest areas would contain high levels of old-growth elements and riparian areas. Stand structure and dynamics and landscape/structure/dynamics/age structures would occur across all geographic areas and within all watershed associations.

The ecological diversity of the forest communities and ecosystems is well-distributed across environmental gradients, geographic areas, and vegetative communities in all alternatives. Overall, the effects are that the full range of disturbance processes would continue across the Forest under all alternatives.

Aquatic Ecosystems and Essential Fish Habitat

Introduction

Fish are a major component of biodiversity of the Chugach National Forest. The annual spawning migrations of anadromous fish (fish that spend part of their life in the ocean such as salmon) are necessary for the function of many plant and animal communities. Anadromous fish are a keystone species, with dozens of birds and mammals consuming salmon or salmon eggs. Animals such as black and brown bear and bald eagles are dependent on spawning salmon, or their carcasses for over-winter survival.

Fish and the other aquatic resources on the Forest provide major subsistence, commercial, sport fisheries, and traditional and cultural values. Abundant rainfall, streams with glacial origins, and watersheds with high stream densities provide an unusual number and diversity of freshwater fish habitats. These abundant aquatic systems of the Chugach provide spawning and rearing habitats for many of fish produced in Southcentral Alaska and Prince William Sound. Maintenance of this habitat, and associated high quality water, is a focal point of public, state, and federal natural resource agencies, as well as user groups, Native organizations and individuals.

Legal and Administrative Framework

There are numerous Acts that have set the basis for the protection and management of fish habitat. These acts have been revised and updated relative to the times. The four most dominant Acts are described below.

- The **Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) -** This act requires an assessment of the present and potential productivity of the land and provides guidelines for land management plans which will insure that timber harvested from national forest lands only where soil, slope, or other watershed conditions will not be irreversibly damaged.
- The **National Forest Management Act of 1976 (NFMA) –** Included in the Act is direction to include coordination of wildlife and fish when providing for multiple use and sustained yield. NFMA also requires the Forest Plan to provide for diversity of plant and animal communities. Implementing regulations specifically identify riparian areas for special management attention and identify an area at least 100 feet from the stream bank or areas dominated by riparian vegetation as a significant area. The regulations also give direction concerning maintaining viable populations of existing and desired non-native vertebrate species and using management indicator species (MIS) to estimate the effects of planning alternatives on fish and wildlife populations.
- The **Alaska National Interest Lands Conservation Act of 1980 (ANILCA) -** ANILCA permits the fishery research, management,

enhancement, and rehabilitation within national forest Wilderness and Wilderness Study Areas. It gives direction to cooperatively plan fish enhancement activities with the State of Alaska and nonprofit aquaculture corporations.

- The **Magnuson Stevens Fishery Conservation and Management Act of 1996 (as amended)** requires that a Federal Agency shall consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may adversely affect any essential fish habitat.
- The **Alaska Forest Resources and Practices Act of 1990 (AFRPA)** provides management direction for both state and federal lands and call for the establishment riparian habitat buffers along all Stream Class (anadromous fish) and Stream Class II (resident fish) streams.

Key Indicators

- Percentage of coho and pink salmon habitat by prescription category
- Acres and miles of improved habitat
- Amount of disturbance from timber harvest

Resource Protection Measures

Forestwide standards and guidelines, the USDA Forest Service Soil and Water Conservation Handbook of Best Management Practices (1996a), and minerals leasing stipulations provide direction for minimizing adverse impacts to water and attendant fisheries resources. The majority of the fish habitat standards and guidelines are defined by soil and water concerns, and are designed to protect and maintain such elements as stream channels, stream banks, riparian vegetation, and water quality. Management indicator species (MIS) will be monitored during project implementation to indicate the effects of management activities on fish and fish habitat.

These protection/mitigation measures may be found in the draft Aquatic Ecosystem Management Handbook (USDA Forest Service 1999b). The basis for protection is the identification of the riparian area. The riparian area is the area identified during project planning that directly affects the form and function of the aquatic ecosystem, stream processes, and the quality and quantity of fish habitat. Riparian areas include the land adjacent to the water body, and the upslope areas that have a direct effect on aquatic habitat (also see Water/Riparian/Wetlands section in this chapter).

The protection measures apply to all alternatives. Once an alternative has been selected and implementation starts, monitoring will be initiated to determine if the appropriate protection measures have been implemented and if the measures

are adequate. Changes in either the method of implementation or the protection measure will occur if either does not adequately protect the fisheries resource.

Habitat Capability

Fish Management Indicator Species

National Forest Management Act regulations direct the use of MIS in forest planning to help display the effects of forest management (36 CFR 219(9)(1)). MIS are species whose population changes are believed to indicate the effects of land management activities. Through the use of MIS, the total number of species that occur within a planning area is reduced to a manageable set of species that represents, collectively, the complex of habitats, species, and associated management concerns.

For the Forest Plan revision, pink salmon, coho salmon and Dolly Varden char were selected as MIS. Pink salmon were selected to represent anadromous fish which are limited in their freshwater life-period by spawning gravel quality and quantity; coho salmon to represent anadromous fish that are generally limited in their freshwater life-period by stream and lake rearing area; Dolly Varden char because of their widespread distribution in freshwater habitats. Cutthroat trout were selected as a species of special interest because coastal cutthroat trout in Prince William Sound exist in small isolated populations at the westernmost extension of their range.

Affected Environment

Forestwide

The Forest includes approximately 4,600 miles of known fish streams and over 110,000 acres of fish lakes ranging from a few acres to the approximately 14,000-acre Kenai Lake. Anadromous fish habitat includes 1,800 miles of documented anadromous streams and 48,100 acres of anadromous fish lakes. Almost 2,000 miles of smaller stream channels are suspected to contain anadromous populations, but are not currently inventoried. Another 2,800 miles of stream provide resident fish habitat, with about 3,000 miles of smaller uninventoried streams. There are over 60,000 acres of resident fish lakes. Most of the Forest's streams and rivers empty into bays or estuaries which are important during some life stages of anadromous fish species as well as for many saltwater fish species. Table 3-24 shows the documented miles of anadromous fish habitat by species and landscape area.

Table 3-24: Documented miles of fish habitat by species and area.

Species	Copper River	Kenai Peninsula	Prince William Sound	Forest Total
Chum	84	109	231	**424**
Coho	616	315	197	**1127**
Cutthroat	191	0	34	**225**
Dolly Varden	429	121	30	**579**
King	174	160	9	**344**
Pink	150	161	590	**901**
Sockeye	557	242	81	**881**

Eulachon, *Thaleichthys pacificus*, are pelagic schooling smelts, that live in marine environments offshore of the Chugach National Forest, and also spawn in fresh water within Forest lands. There are two major spawning populations on the Forest. These are found on the Twentymile River on the Kenai Peninsula area and on the Copper River Delta.

Grayling, though not native to the Chugach National Forest, are currently found within the Kenai Peninsula and the Copper River. These populations are the result of an earlier introduction of grayling, and have become self-sustaining populations. Presently they occupy the Crescent Lake watershed on the Kenai and 18 Mile ponds on the Copper River Delta.

Channel Inventory and Stream Habitat Types by Landscape Area

All known perennial streams have been mapped and identified using the Alaska Region Stream Channel Type System. For a description of each channel type, see *A Channel Type Users Guide for the Tongass National Forest* (USDA Forest Service 1992a). These channel types have been found to fairly consistently fit the streams on the Chugach National Forest. Individual channel types have fairly consistent physical and biological characteristics (Marion et al. 1987; Edginton et al. 1987; and Murphy et al. 1987). The channel types provide a system to estimate the amount and quality of fish habitat and can be used to predict their physical response and sensitivity to different management activities. Channel types have been categorized into distinctly different groups, called “stream process groups.” Process groups are used for assigning the Fish Habitat and Riparian standards and guidelines. These are set out under the draft Alaska Region’s Aquatic Ecosystem Management Handbook (USDA Forest Service 1999b). Table 3-25 displays the amount of the channel type process groups found throughout the Forest by landscape area.

Table 3-25: Miles of stream by process group and area.

Process Group	Copper River	Kenai Peninsula	Prince William Sound	Forest Total
Alluvial Fan	54	66	98	218
Estuarine	277	6	127	410
Flood Plain	251	165	169	584
Glacial Outwash	1,105	287	411	1,802
High Gradient Contained	566	1,211	2,223	4,000
Low Gradient Contained	0	30	15	45
Moderate Gradient Contained	79	97	351	527
Moderate Grad/Mixed Control	46	202	272	520
Palustrine	611	85	71	766
Total	**2,990**	**2,147**	**3,736**	**8,873**

The Copper River landscape area is characterized by large amounts of Glacial Outwash streams, Palustrine and Floodplain type streams. Mountain glacier melt water is the source of runoff to the Glacial Outwash streams. Consequently these steams carry extremely high sediment loads and turbid water. Riparian areas are wide and may extend for several thousand feet of either side of the channel. These channels are accessible to anadromous fish in their lower reaches. Typically they provide migration routes to salmon spawning in clear water tributaries. The fine sediment in the spawning beds normally limits spawning gravel quality. Sockeye tend to select gravels where upwelling groundwater is present. Rearing habitat is generally limited to slough and side channel pools due to turbid water conditions.

The Palustrine streams are low gradient streams associated with bogs, marshes, wetlands, and lakes. These channels are shallowly incised, have fair flow containment, and flood flows usually overtop the stream banks and flow onto the adjacent landform, lessening downstream flooding and serving as a buffer during the major storms. Productivity of the channel is moderately tied to the riparian/terrestrial interaction. The Palustrine streams have high production capability for coho salmon. Spawning gravels are not abundant, but are usually more limited in "overwinter" habitat due to lack of large complex pools that provide quality winter habitat. The better rearing habitat, winter habitat is tied to undercut banks and large woody debris accumulations, as well as larger ponds and lake outlets.

High gradient contained stream channels dominate the Kenai Peninsula watersheds. These channels generally have low fish habitat capability. The productive areas for fish habitat on the Kenai Peninsula are dominated by Floodplain and Moderate Gradient with mixed control of stream banks channel types found in the valley bottoms. These floodplain and channels have two-way interaction between the stream channel and floodplain area through bank erosion, channel migration and overflow, leaf fall, and blow down/tree fall. These channels receive moderate to high spawning use by all anadromous species. Coho salmon and Dolly Varden char use the available rearing areas of these channels extensively. Much of the better rearing habitat, particularly the coho salmon rearing habitat, is associated with large woody debris accumulations,

beaver dams, and off channel sloughs. Sockeye production is associated with large lake systems found within the Kenai watershed, but frequently use the flood plain and mixed control channels for spawning.

Watersheds in Prince William Sound are dominated by high gradient channels. Productive fish habitat is also dominated by the relatively small percentage of floodplain and mixed control habitat types. Unlike the Kenai landscape area, Estuarine Channel Type streams, though small in total miles, are extremely important within the Prince William Sound. Sockeye salmon producing watersheds are limited in extent within Prince William Sound. Coghill Lake and Eshamy Lake are primary producers of sockeye in Prince William Sound. These channels are always accessible to anadromous salmon, and provide the primary area for pink and chum spawning.

Fish Stream Class Inventory.
Channel typed streams have also been categorized by stream class, a classification primarily associated with fish use. Class I streams are anadromous and high value resident fish streams, Class II streams are other resident fish streams, and Class III streams are managed for water quality and where appropriate, downstream aquatic resources. Stream classes describe stream values, such as whether anadromous or resident fish inhabit a particular stream. Fish Habitat standards and guidelines are based in part on the stream class. Table 3-26 shows the miles of stream by channel type.

Table 3-26: Miles of class I, II, and III streams.[1]

Stream class	Copper River	Kenai Peninsula	Prince William Sound	Forest Total
Class I	1,991	521	765	3,277
Class II	156	554	725	1,435
Class III	566	1211	2,223	4,000
Total	**2,713**	**2,286**	**3,713**	**8,712**

[1] Does not equal totals in other tables due to some stream segments without stream class designation.

Current Management of Fish Habitat
Current fisheries habitat conditions on the Forest are near levels of natural productivity. Management actions that could be detrimental to fish habitat have occurred on limited amounts of stream habitat. Approximately 16 miles (less than one percent) of anadromous fish streams have had commercial logging within associated riparian habitat. Another 73 miles (less than one percent) of non-anadromous streams have had logging within associated riparian habitats. Water withdrawal has also affected a very small percentage of stream habitats, less than 5 miles. In addition, mining has impacted a small, though currently unknown, percentage of stream habitats within the Forest. Currently, there are watershed analyses being undertaken to address the most pressing of these problems.

Of concern, primarily on the Kenai Peninsula, is the long-term effect of the spruce bark beetle infestation. Specifically, the long-term changes to fisheries

habitat resources associated with loss of large spruce trees found within riparian zones are of concern. Frequently, spruce stands are a major component of riparian vegetation, particularly along streams with developed floodplains. These are typically some of the most productive fish streams. Currently, there are 65 miles of high value, Class I streams that have been impacted by the spruce bark beetle. These are concentrated on several high fisheries value streams, particularly the Russian River, East Fork Sixmile Creek, Juneau Creek, Resurrection Creek, and Quartz Creek.

Habitat Enhancement

Commercial fish harvest in the waters of Southcentral Alaska can fluctuate widely from year to year. For example, wild salmon harvest in Prince William Sound averaged approximately 8 million fish for the past 30 years. Since 1971, harvest of coho salmon and sockeye salmon attributable to Forest streams from the Copper River/Bering River are estimated to average 80,000 sockeye and 500,000 coho. Chugach National Forest streams on the Kenai Peninsula are estimated to produce an estimated annual harvest of 375,000 sockeye, 1,400 king, and 32,000 coho salmon. Current fish hatchery production in Prince William Sound averages 32 million fish, with 90 percent being pink salmon. Minor hatchery augmentation occurs on the Chugach National Forest portion of the Kenai Peninsula. Sport harvest within these same waters has also risen dramatically, increasing more than 100 percent in the waters within and adjacent to the Chugach.

Numerous fish habitat enhancement projects, and a variety of hatchery and other aquaculture projects, have been developed on the Forest. Two groups coordinate fish enhancement and development activities in Southcentral Alaska: the Prince William Sound-Copper River Regional Planning Team and the Cook Inlet Regional Planning Team. The Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division facilitates the activities of the coordinating groups. Between 1984 and 1997, 60 anadromous fish and 27 inland fish enhancement projects were coordinated by the Forest Service.

Environmental Consequences

The environmental consequences discussion that follows provides an assessment of management action impacts on essential fish habitat as directed in the consultation agreement between the Forest Service and the National Marine Fisheries Service.

General Effects

Fish and aquatic habitat can be affected by a variety of management activities including road construction, timber harvest, fire management, intensive recreation use, water depletion and diversion, and mineral development. These management activities may cause some adverse changes in fish and aquatic habitats that may affect the water balance or alter sediment and nutrients inputs. Fundamental changes to a watershed can create structure and function changes

in streams. This, in turn, can result in the change in numbers, growth, and distribution of fish.

Management activities can change fish and aquatic habitat in several ways. First, loss of stream bank stability or watershed soil structure and stability can contribute to the increases in the amount of sediment being added to the aquatic systems. The addition of sediment to aquatic systems as a result of watershed disturbance and erosion eliminates aquatic insect habitat, reduces the permeability of spawning gravels, and degrades pools and rearing areas (Chamberlin et al. 1991). Stream bank erosion can also contribute to the loss of available habitat. These changes usually lead to reduced spawning success, decreased capacity to support rearing fish, slower growth, and increased predation.

Another significant factor is a decreased supply of large woody debris (Doloff 1983). This may result in long-term losses of fish habitat. Reduction in the amount of pools and the available hiding cover decreases the rearing habitat capability, particularly over wintering habitat, and decreases spawning success. The species diversity in the stream may be reduced and predation on fish increased. The less complex habitat also loses some of its ability to capture gravels and organic matter important to spawning and rearing fish. Also, the large woody debris provides a substrate for food production.

Combined Rearing Habitat Capability Group – Management Indicator Species (MIS) are used to evaluate the relative potential impact on stream rearing fish habitat. These include coho and pink salmon, cutthroat trout (resident and anadromous), rainbow trout, and Dolly Varden char (resident and anadromous). Typically these fish use streams or rivers for spawning and their fry, upon emergence, rear in the stream habitat for one or more years (resident cutthroat trout and Dolly Varden char depend on freshwater systems, including streams, throughout their life cycle). The relative risk to each of these species could be influenced by the proportion of their life cycle residing in the freshwater ecosystem. Since resident cutthroat trout and resident Dolly Varden char are dependent on freshwater ecosystems throughout their lives, they could be at greatest risk. Some species such as cutthroat and rainbow trout appear to have isolated populations, which may be more susceptible to local impacts. Coho salmon both spawn and rear (for one or more years) in freshwater. The survival of these fish depends on the deep, quiet pools created by large woody debris, undercut banks, backwater sloughs and channels, and large bottom substrates (Heifetz et al. 1986).

Forest streams with uncontained stream channels, i.e., floodplain, palustrine, moderate gradient mixed control, estuarine, and alluvial process groups, are the most productive and sensitive channel types on the Forest. The balance between flow regime and sediments of the valley bottom controls alluvial channel form. Management activities that impact streamside vegetation can weaken channel banks and remove large woody debris sources. Removal of the streamside vegetation increases sediment supply and can cause the channels to become wider and shallower, with fewer pools and more riffles. This creates

conditions that support less coho juveniles. Bedrock controlled reaches, whose channel form is dictated by the bedrock control of valley wall or stream bank, are more resilient and stable to changes in stream flow and sediment supply. These bedrock reaches are contained within the Low Gradient Contained, Moderate Gradient Contained, and High Gradient Process Groups. See Table 3-25, Miles of Streams by Process Group and Area, for distribution of these habitats on the Forest.

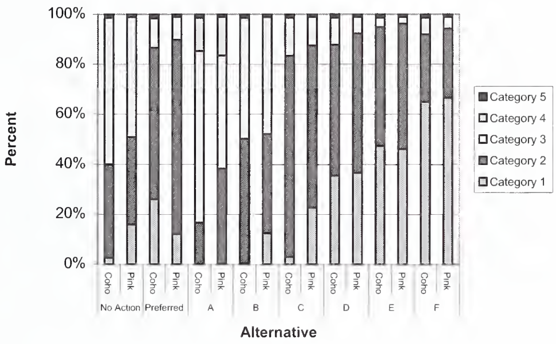
Coho salmon are highly dependent on quality rearing habitat for their health and growth in the freshwater environment. Coho juveniles spend 1 to 2 years in freshwater before emigrating to saltwater as smolts. The quality and quantity of year-round rearing habitat are the basis of the production potential of streams. For coho salmon, the number of smolts produced by the stream system is directly related to the winter survival of the juveniles. The number of adult coho available to the subsistence, sport, and commercial fishery as well as the brood stock escapement is directly related to the number of smolts.

Combined Stream Spawning Capability Group - A combined group of fish includes coho, pink and chum salmon, rainbow trout, cutthroat trout (resident and anadromous) and Dolly Varden char (resident and anadromous). Typically these fish use streams or rivers for spawning, and their fry, upon emergence, rear in the stream habitat for one or more years (resident cutthroat trout and Dolly Varden char depend on freshwater systems, including streams, throughout their life-cycle); or, as with chum and pink salmon, migrate to salt or brackish waters to rear. Pink and chum salmon rear in saltwater after emergence from freshwater incubating habitats. Since pink and chum salmon have relatively similar habitat requirements, and are highly tied to the abundance and quality of spawning habitat, pink salmon is used to represent the group since they are more widely distributed on the Forest than chum salmon. Substrate composition, water quality and quantity, water depth and velocity are important components for pink salmon spawning and successful incubation of eggs to fry. Spawning generally occurs in riffles, with preferred sites occurring at the pool-riffle interface. A constant supply of clean well-oxygenated water is critical to the survival of eggs in the gravel. Unlike coho, pink salmon do not spend 1 to 2 years rearing in freshwater. Not long after emergence from the gravel, pink fry start their out-migration to saltwater. Management actions that could potentially affect pink habitat capability are those that would alter migration of juveniles or adults, or affect the spawning and incubation habitat by increasing the amount of fine sediments in the gravel or by destabilizing the gravel.

Generally, as total miles of roads and acres of potential timber harvests increases and recreation sites and mineral sites are developed, the potential of altering the structure and function of critical habitat is increased. Therefore, the possibility of impacts to species abundance increases with increased miles of road constructed and acres harvested, or intensive recreation management within riparian habitats. For some species, such as small isolated populations, the potential impact may have greater significance than for others.

A qualitative method to determine this potential risk to spawning and rearing habitat is to look at the percentage of the anadromous fish habitat that is within the five prescription categories (Figure 3-11). As the prescription category increases the potential level of management intensity increases. Implementation of Category 1 and 2 prescriptions, with their low level of ground disturbing activities, such as roads, trails, timber harvest units, and campgrounds, has a low probability of altering the structure and function of fish habitat. Those alternatives that have a higher percentage of Category 1 and 2 prescriptions have less risk for potential negative effects to aquatic habitat. Only coho and pink salmon percentages have been graphed, as the distribution of cutthroat and rainbow trout, and Dolly Varden char are not fully represented on the Forest Streams GIS layer. Also coho salmon and pink salmon serve as representatives for the combined rearing and spawning groups.

Figure 3-11: Percentage of coho and pink salmon habitat by prescription category.



In order of decreasing risk (greatest risk to least risk) to both the physical characteristics of stream channels and the species considered, the alternatives can be ranked in this order: Alternative A, the No Action Alternative, Alternatives B and C, the Preferred Alternative, and Alternatives D, E and F.

Salmonid Viability

It is recognized that regardless of the level of fish habitat protection, some level of risk remains that fish habitat could be impacted by some management activities. The conservation of the aquatic community and salmonids within watersheds of the Chugach National Forest is based on a strategy that addresses both individual species as well as entire watershed assemblages (Marcot et al. 1994). The species approach is important for management indicator species (MIS), species of special interest (SSI), or sensitive or rare species. The species-specific approaches, such as MIS, have not always been successful in protecting biodiversity (Angermeir and Schlosser 1995). Grossman

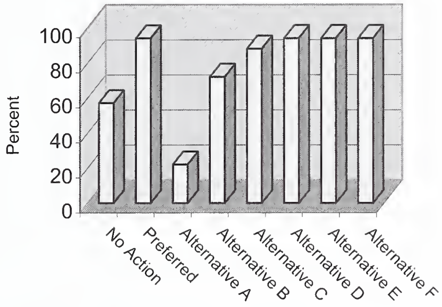
and others (1995) contended that maintenance of fisheries is best accomplished at the landscape scale. Bisson and others (1997) argues that managing aquatic habitats with emphasis on natural disturbances would promote conservation of aquatic organisms contained within those watersheds. But the conservation of aquatic ecosystems or communities may be more important than individual species protection, and may be a more viable strategy for keeping species populations at fishable numbers well-distributed.

Species focused approaches should be complemented by efforts to protect distinctive landscapes or watersheds. Grossman and others (1997) and Bisson and others (1997) state that though stream reaches can be defined as discrete habitat units, the connectedness of the habitats is essential for long-term salmonid viability. For freshwater aquatic ecosystems the watershed concept should work. It is assumed that Category 1 and 2 prescriptions protect the natural processes at a landscape scale and continue the continuity of the separate habitat units. The exception to this is within watershed associations on the Kenai Peninsula that have had extensive placer mining operations. These include the Resurrection Creek, Juneau Creek and Cooper Creek watersheds. Here the Chugach National Forest watersheds are still dominated by native species; the natural processes are still functioning within the expected range of variation within these undisturbed watersheds.

To further evaluate level of risk, the percentage of watershed associations where natural processes dominate are identified. Management areas with prescription Category 1 and 2 were considered to fully protect watershed and habitat values. Watershed associations were considered large enough to maintain the core values needed to maintain habitat characteristic. The watershed associations were examined to determine whether any were predominately (95 percent) Category 1 or 2 prescriptions.

Figure 3-12 shows by alternative the percentage of watershed associations that are 95 percent or more within Category 1 or 2 prescriptions.

Figure 3-12: Percentage of watershed associations within Category 1 and 2 prescriptions.



The maintenance of watersheds within primitive and semi-primitive prescriptions, if fully implemented, does however address the NFMA regulation regarding habitat for maintaining viable, well-distributed populations in the Forest. Alternatives D, E, F, and the Preferred Alternative maintain nearly all (94 percent) of all watersheds within prescriptions that protect watershed an fish habitat values. Only Alternative A has more than half of the watersheds within developmental oriented prescriptions.

This "coarse filter" approach keeps ecosystem components within the expected range of variability; other stressors for populations have been identified. These are the potential viability risks to pink salmon from permitting fish hatcheries, or risks to cutthroat trout due to increases in angling pressure within Prince William Sound.

Pink Salmon

Supplemental production of hatchery produced pink, sockeye, chum, coho, and king salmon occurs within Prince William Sound. The Prince William Sound Aquaculture Corporation operates five hatcheries, and the Valdez Development Association operates another. The issue of the enhancement of the hatchery stocks of salmon for the Forest Service at the Main Bay and Cannery Creek Hatcheries, the two hatcheries with Chugach National Forest special use permits, has on wild, or naturally occurring stock is addressed in this section. Primarily, the Forest Service issue is with sockeye salmon at Main Bay, and wild pink salmon throughout Prince William Sound.

Currently, there is much uncertainty about the effect of hatchery production on the productivity and long-term production of biological surplus of wild salmon stocks within Prince William Sound. The additional sockeye salmon smolts and pink salmon fry produced at these hatcheries, potentially increase resource competition and genetic interactions between wild and hatchery stocks. Sharp and others (1994) reported high rates of straying of hatchery produced pink salmon into streams within Prince William Sound. Without mitigation, hatchery produced salmon could potentially dilute locally adapted gene pools of naturally produced salmon through straying and result in shifts of traits that directly relate to the fitness of these stocks (Eggars et al. 1991). Changes in size at maturity, age at maturity, migration, or spawning times, or egg emergence times could occur. Such changes could have a bearing on the long-term survival of those stocks, although the short-term effects would probably not be detectable.

There has been mixed success in meeting wild pink stock escapement goals (Kron 1998). ADF&G manages for wild stock escapement, consequently when escapement numbers in index streams (streams that are monitored for spawners) are low, the interception fishery is curtailed and commercial fisheries are restricted to terminal harvest areas, which lie outside the wild-stock migration corridors. The escapement goals for the pink salmon in Prince William Sound have generally been reached, though there is growing evidence that the large scale production hatchery stocks appears to be replacing pink salmon wild stock production, rather than augmenting the total production. Eggars and others in 1991 and Tarbox and Bendock in 1996 both suggested that hatchery fish were responsible for the decline in wild pink salmon production. Interaction of wild and hatchery stocks may also occur during adult return and commercial fishing activities. There may be wild stocks of several different species that would be intercepted during commercial fishing efforts directed at hatchery stocks. Recently Hilborn and Eggars (2000) have argued that hatchery stocks of pink salmon are impacting the wild pink salmon returns through over harvesting wild salmon stocks in a mixed stock fishery, and wild and hatchery pinks are sharing ocean habitat. There is also uncertainty about the effect of hatchery stocks flooding the wild stock gene pool. Potential loss of genetic fitness might result in lower reproductive juvenile and adult survival rates and loss of long-term viability.

The viability of pink salmon within Prince William Sound probably is not in question, though genetic integrity of stocks and long-term productivity of wild stocks within certain portions of Prince William Sound or individual streams may be in question. The escapement goals for streams within Prince William Sound have been met every year since the inception of the hatchery program (Kron 1998). Escapement throughout individual streams has been somewhat variable, with inadequate escapements in some commercial fishing districts in Prince William Sound in some years. Uniformity of escapement is another issue. While overall yearly escapements may have been reached, escapement may have been inadequate within certain commercial Sub-Districts. The ability of wild systems to produce biological surplus for subsistence, sport, or commercial uses may be compromised by continued high hatchery production and mixed stock commercial fisheries.

Though escapement goals have been met in most years, it appears that viability of wild stocks of salmon is generally maintained, though the contribution of wild salmon carcasses to the freshwater and riparian ecosystem would be reduced significantly. Wilfli and others (1998, 1999) have described the influence of salmon carcasses on the stream productivity and concluded that they provide key nutrients for high salmon production, as well as providing ecosystem nutrition for riparian associated plants and animals. The loss of this potential nutrient source on ecosystem function needs research. Run strengths of Coghill Lake sockeye salmon have also been strong in recent years, following sockeye fry supplementation and lake fertilization programs, so viability issues are also probably not present.

These issues of wild stock impacts need to be addressed by the Prince William Sound Advisory Council and ADF&G. Studies could include mark and recovery programs, genetic baseline determinations, genetic marking, fishery interception determination and others needed to effectively validate the existing hatchery programs and to provide direction to the program to assure protection of wild stocks.

Cutthroat Trout

Coastal cutthroat trout (*Oncorhynchus clarki clarki*) are found through Prince William Sound and the Copper River Delta. They are found as anadromous (sea run), potomodromous (river run), Lacustrine (lake run), and resident populations (Trotter 1989). Cutthroat stocks known to exist within Prince William Sound are small and geographically isolated. Williams and others (1998) have found that resident and anadromous populations in small genetically isolated populations within Prince William Sound. This is consistent with the hypothesis that low barriers are barriers to upstream cutthroat migration, and as such several of the populations may exist in unknown levels of reproductive isolation and genetic differentiation. Above barriers, the small fish are genetically isolated from anadromous forms, but how much downstream migration is unknown (Johnston 1981). Heggens and others (1991) found that coastal cutthroat trout showed little migration within small streams, and larger fish were least likely to move.

Populations of coastal cutthroat have been surveyed within some of western Prince William Sound; other areas throughout the Sound may contain populations of cutthroat trout (Barto et al. 1984, Pelliser et al. 1985a, Pelliser et al. 1985b, McCarron and Hoffman 1993). Populations were impacted by the *Exxon Valdez* oil spill. Growth of anadromous populations was significantly reduced (Hapler et al. 1993). The recovery level of growth rates of cutthroat trout is unknown at present. Arguments have been made that cutthroat trout populations within western Prince William Sound might be in jeopardy due to the relative isolation, small population size, ease of capture by anglers, and projected increase in angler numbers due to the Whittier road, and the potential increase in numbers of anglers employing outfitters and guides. Currently, no guides or outfitters with Chugach National Forest special use permits are targeting freshwater fishing opportunities (Hennig personal communication).

Projected angling impacts are currently quite modest with western Prince William Sound. Cutthroat harvest numbers since 1988 for all of the Prince William Sound area has ranged from 122 in 1995 to 1,511 in 1989, averaging 705 fish (Howe et al. 1999). In 1998 the estimated harvest was 737, while total numbers caught was 4,101. This indicates that a high level of catch and release occurs for cutthroat. In 1998 the number of fish harvested within western Prince William Sound was estimated to be 109, assuming all other streams and lakes not listed by Howe and others (1999) are within this area. While this is a low number, because of the unknown location of many of the populations, the small size of many of these populations, and their genetic isolation, future research and monitoring would be useful in assuring viability of the populations.

Direct and Indirect Effects on Fisheries and Aquatic Habitat

Effects from Fish Habitat Management

Fish habitat management is focused on salmon and trout habitat protection, restoration, and enhancement. Primary emphasis of the program is protection of existing habitat value. Restoration of damaged habitat resulting from human caused or natural events is also an important component of the program. The final program component is enhancement of habitat values. While enhancement projects may not result in large increases in anadromous and inland fish, compared to current natural and hatchery production, increasing access and value of habitat can benefit fisheries in several ways. Enhancement is focused on localized populations that can benefit subsistence, sport, or directed commercial fisheries. The habitat is also used to buffer the effect of commercial fisheries on wild stocks.

The amount of fish habitat manipulation proposed during the planning period varies by alternative and would be spread across the Forest. Table 3-27a shows the proposed fish habitat enhancement program. Improvements are allowed within all prescription categories, though implementation of projects is constrained by difficult access and program implementation requirements within Recommended Wilderness Management Areas. These restrictions require significantly more resources to accomplish an equal numbers of acres and miles. Alternatives E and F have fewer miles and acres because natural processes would dominate fish management.

Table 3-27a: Miles and acres of fish habitat management by alternative (annually).

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Anadromous Habitat								
Stream Improvements (miles)	82	82	82	82	82	82	82	82
Lake Improvements (acres)	1,722	1,722	1,722	1,722	1,722	1,722	1,722	414
Riparian treatments (miles)	222	222	222	222	222	124	93	93
Inland Fish Habitat								
Stream Improvements (miles)	0	0	0	0	0	0	0	0
Lake Improvements (acres)	391	391	391	391	391	391	258	191
Riparian treatments (miles)	25	25	25	25	25	14	11	11

Effects from Road Construction

Road construction and use may be the greatest potential sediment source over both the short term and long term. Roads constructed in riparian areas can constrict floodplains and channels resulting in changes to channel morphology and fish habitat (Furniss et al. 1991). Road construction on steep mountain and hillslope landforms commonly found on the Kenai Peninsula increases the likelihood of landslides, which transport large quantities of sediment and woody debris. The rate of failure would be dependent on storm events. Upon reaching streams, the material can block or cause channel shifts, alter existing habitat structures, fill in pool rearing habitats, and increase fine sediment in spawning gravel. These changes would likely decrease the habitat capability to produce fish.

Approximately two percent of the watershed associations on the Chugach are currently roaded. However, none of the 95 watershed associations are considered to be roaded in relation to roads causing fundamental watershed process changes. The percentage of roads would increase under all alternatives, though the No Action Alternative and Alternatives A and B are the only alternatives that propose to build more than a few miles of new road per decade.

Cederholm and others (1982) found that in the Clearwater River within western Washington, the percentage of fines sediments in spawning habitat increased above natural levels when roads occupied more than 2.5 percent of the basin area. King and Tennyson (1984) found that hydrologic behaviors of small watersheds were altered when roads occupied more than 4 percent of the watershed.

The existing and new roads associated with the No Action Alternative and Alternatives A and B fall below these threshold levels. The only network of roads that were considered for analysis were the four watershed associations considered for timber entry under high market values. The maximum increase, given a scenario where all harvest activities and road-building activities were

contained within a specific watershed, is the 30,400-acre McKinley Lake watershed. McKinley Lake was chosen because it has the highest concentration of potential roads within a watershed association. Alternative A, under the high timber market conditions, has the highest potential road density. The road density would be 0.03 percent, two orders of magnitude below the threshold.

Roads can also be viewed as causing risk to fish movement, primarily due to culverts being used on moderate to high gradient streams. At highest risk are stream-rearing fish, particularly cutthroat trout and Dolly Varden char, which occupy the smaller headwater streams during some parts of their lives. In general, resident species are not as sedentary as previously thought (Armstrong and Elliott 1972, Trotter 1989). High quality spawning habitat may be some distance from high quality rearing or over wintering habitat of lakes, ponds or pools of large rivers. Juveniles of other stream-rearing fish such as coho salmon are often highly mobile during their freshwater stage, moving seasonally between stream reaches, so they are also at risk. Survival often is dependent on this seasonal movement (Bustard and Narver 1975). Restrictions in upstream movement could have impact to overall habitat capability. A recent report on the Tongass National Forest (Flanders and Cariello 2000) found serious problems with culverts blocking fish movement. Preliminary results, based on criteria that approximate juvenile fish passage at mean flood condition, suggest that up to 85 percent of the culverts located on salmon streams and up to 66 percent of the culverts located on resident trout streams were not considered to be adequate for fish passage. The relative risk to fish passage would be related directly to the miles of road constructed and number of stream crossings.

Given these criteria, Alternatives A and B would have nearly the same risk as they would have nearly the same road mileage (220 miles) at the end of first decade. The No Action Alternative would have about 170 miles of road. In descending order of risk from road effects are the Preferred Alternative and Alternatives C, D, E, and F, all with significantly less road, between 120 and 130 miles.

Effects from Timber Management - Timber harvest activities increase risk to fish resources. The risks of these effects are proportionate to the intensity of the management treatments, the juxtaposition to the riparian areas, and the sensitivity of the harvest area to increased erosion. Of particular concern is the protection of riparian areas including flood plains, areas of riparian vegetation, and certain wetlands associated with riparian systems. Commercial timber harvest is not permitted in riparian areas. However, non-commercial harvest and other tree removal is permitted in some riparian areas. Also of concern is the amount of protection afforded steeper channels (often not fish-bearing) in the headwaters areas. It is important to maintain the natural function of these steeper channels, including the V-notches. Forested leave strips are considered to be an important measure to insure protection of headwater areas (Murphy and Koski 1987). However, there is risk of unanticipated stream habitat effects such as accelerated numbers of landslides over background levels, blow down of riparian buffers, and the cumulative effects of many small and individually

insignificant actions affecting fish habitat capability. Harvest activities may increase erosion and siltation of streams and reduce large woody debris input to streams as a result of riparian vegetation disturbance. There is potential for reduction of key habitat components, for juvenile coho with regard to disturbance of off channel habitat and low gradient tributaries. Management influence on off-channel habitat usually consists of bank disturbance, small logging debris loading of these habitats, and sedimentation or disturbance from upstream activities that are not mapped before timber harvest. Mitigating these potential effects by avoiding or minimizing timber harvest activities in riparian areas is felt to be the key means of minimizing impacts to fisheries habitat from logging (Chamberlin 1982, Dolloff 1987, Murphy et al. 1986, Johnson et al. 1986).

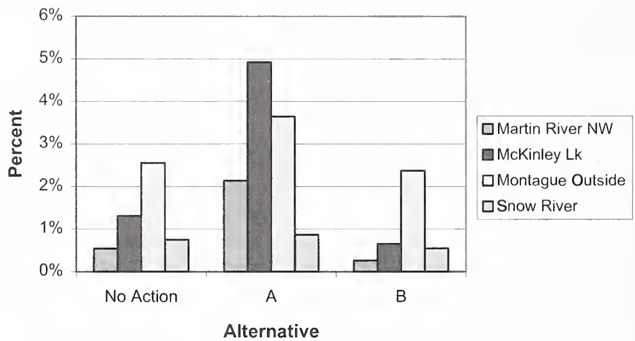
Timber harvest within riparian areas may lead to increases in primary productivity and secondary productivity. Increases in summer water temperatures created by reduced canopy closure from timber harvest or other vegetation removal projects may also increase algae growth. Other possible outcomes to increased sunlight/increased algae growth are increased water temperature and a decreased solubility of oxygen in the water. This has been documented to result in increased adult fish respiration causing fish mortality in heavily logged watersheds. These can lead to increases in summer salmonid carrying capacity. For stream-rearing fish, both resident and anadromous, the amount of overwinter habitat is considered critical.

Intensive timber harvest activities have potential to impair hydrologic function in watersheds. Concerns for impaired hydrologic function include peak flows, sediment transport and summer low flows. The peak flow and sediment transport issues are closely interrelated. Studies in the Pacific Northwest have shown a range of stream peak and low flow responses to various levels of watershed harvest. An Alaska study speculated that measurable decreases in flow occurred when 30 percent of a watershed was harvested. Tongass land management planners recommended a threshold level, following a recommendation by a team of hydrologists (Cumulative watershed effects, 1996) of no more than 20 percent of the acres in a watershed will be in an age class of 30 years or less (USDA Forest Service 1996b). The 1995 Alaska Region Anadromous Fish Habitat Assessment Report to Congress indicates that declines in salmon capability may occur after timber harvest of more that 25 percent of the watershed (USDA Forest Service 1995a).

The implementation of the Alaska Region’s Best Management Practices and Riparian standards and guidelines outlined in the Tongass Land Management Plan were judged to be inadequate for completely protecting productivity of aquatic habitat (USDA Forest Service 1999b). As stated above, heavily logged watersheds, those with more than 25 percent of their acreage harvested, would have a loss of fish habitat productivity. In contrast to these highly developed watersheds, alternatives considered in the Chugach Forest Plan revision effort, have much lower levels of potential development. Figure 3-13 displays the percentage of the four watershed associations that timber harvest would possibly occupy within the next decade. Harvest occurs only in the No Action Alternative

and Alternatives A and B. None of the alternatives proposes harvest of more than 5 percent of the watershed associations. Given the low intensity of harvest, no fundamental changes in watershed processes affecting fish habitat would be likely.

Figure 3-13: Percentage of watershed associations harvested under high market conditions.



Source: Chugach National Forest GIS corporate database Stream and Watershed layers.

The No Action Alternative and Alternatives A, and B increase the likelihood that fish dependent on the freshwaters of the Forest could be negatively affected by timber management activities. Although there are specific measures in each alternative designed to reduce the likelihood of significant degradation of fish habitat, there remains a risk to fish associated with management activities planned under each alternative with commercial timber harvest. Several studies have shown that buffer strips are adequate in protecting site-specific fish habitat (Murphy et al. 1986, Johnson et al. 1986, Barton et al. 1985). The potential of timber harvest to reduce coho and pink salmon habitat capability is mitigated by the protection of near stream resources by no harvest zones as prescribed in the draft Aquatic Ecosystem Management Handbook (USDA Forest Service 1999b), and by BMP effectiveness in protecting water quality in the upstream habitat areas. The impacts would be directly related to the effectiveness of the implementation of the standards and guidelines.

Effects from Fire Management

Fire can have both positive and negative effects on fish and their aquatic habitat. Fire can release important elements such as nitrogen and phosphorous into the aquatic systems. These increases are temporary and usually dissipate after re-vegetation occurs. There is speculation that such increases could increase the productivity of the steams during this period. Alaskan streams are relatively

sterile. Thus, productivity increases in plants and animals that provide food sources may lead to increases in numbers of fish.

Key physical components of a fully functioning aquatic ecosystem include complex habitats consisting of floodplains, banks, channel structure (i.e., pools and riffles), and subsurface waters. These are created and maintained by upslope disturbance processes, including fire, that supply nutrients, woody debris, and water. Large intense fires may lead to changes in these upslope processes. These wildland fires can have short-term detrimental effects, particularly to certain fragile soil and channel types, in the form of increased sedimentation, channel degradation, and changes in stream temperature regimes. Wildland fires would average about 15 acres each year under all alternatives.

Over time (500 years or more), streams within the Kenai watershed are clearly disturbance-dependent systems. To maintain aquatic viability throughout a large drainage basin, it is necessary to maintain features of the natural disturbance regime. Fire is a factor in the natural disturbance regime on Kenai forested watersheds.

Alternatives that propose the greatest use of prescribed fire to reduce fuels and manage vegetation would directly benefit aquatic habitat, while concurrently reducing the risk of large catastrophic wildfires that could, at least in the short term, damage aquatic systems. The No Action Alternative, the Preferred Alternative, and Alternatives A, B, and C propose approximately 27,000 acres of burning during the first decade on the Kenai Peninsula. Alternative D proposes about three quarters as much and Alternatives E and F propose about half as much. Table 3.27b shows the potential number of stream miles by stream class that would be within or adjacent to prescribed burns.

Table 3-27b: Potential stream miles affected by prescribed fire – decade 1.

	Alternative							
Class	No Action	Preferred	A	B	C	D	E	F
Class I	14.7	14.7	14.7	14.7	14.7	11.4	7.4	7.4
Class II	15.6	15.6	15.6	15.6	15.6	12.1	7.9	7.9
Class III	34.1	34.1	34.1	34.1	34.1	26.5	17.3	17.3
Total	**64.4**	**64.4**	**64.4**	**64.4**	**64.4**	**50.0**	**32.6**	**32.6**

Effects from Lands And Special Use Management

Dams and water diversions can have significant effects on aquatic and riparian habitat and fish migration by changing channel dimensions, altering aquatic and riparian habitat, and obstructing fish migration. The degree of these effects is currently unknown.

As permits are amended, renewed, or issued, the Forest will analyze environmental effects to determine if additional mitigation measures or new terms and conditions are required. Effects would be similar under all proposed

alternatives, since the compliance standards included in permit issuance would not vary by alternative.

Effects from Minerals Management

Mining and fossil fuels extraction can affect fish and aquatic habitat. Mining can be a significant source of bedload sediment or toxic heavy metals introduced into streams. Other risks include altered streamflows and channels, acid-mine drainage, toxic substance spills, and altered temperatures. Normally, water is needed in mining operations, and this depletion of streams or underground aquifers may also adversely affect fish habitat.

Both hard rock mining and oil and gas leasing operations proposed on National Forest System lands include a variety of resource protection stipulations and requirements. These operations are carefully monitored to ensure compliance with the terms of the mine operating plan or lease agreement. Even though these protection measures are required under all proposed alternatives, it is still reasonable to assume that those alternatives that open the most acreage to mining or oil and gas leasing potentially pose the greatest risk of adverse direct, indirect, or cumulative effects to fish and aquatic habitat.

In terms of risk assessment, the alternatives, from greatest to least risk, would be ranked as follows: Alternative A would open the most acres to mining, followed in order by, Alternative B, the No Action Alternative, Alternative C, the Preferred Alternative, and Alternatives D, E, and F (see Table 3-95).

Effects from Recreation Management

The relation between recreation and salmon aquatic habitat is complex. It represents a relation between habitat and the people. The indirect effect of overuse of streamside zones by recreational users is difficult to judge. The criteria to judge the potential effects of recreation of aquatic habitat are the amount and number of recreational visitor days and the degree of access. Sport fishing is a major recreational activity on the Forest, but a variety of other recreational uses, such as motorized vehicle use, boating, hiking and horseback riding, could damage riparian and aquatic habitats. Some of the activities are dependent on the aquatic environment and have potentially more impact on fish habitat. Fishing, particularly at areas where returning adult salmon congregate, may create localized impacts. Such sites are currently found on the Russian River and Quartz Creek and impacted sites are increasing as recreation use increases.

Recreational use can affect aquatic habitat in many ways. The most obvious ways on the Chugach National Forest is through the loss of streamside riparian vegetation and changes in the upland soils. Riparian zones are transitional areas that lie between the river channel and the upland. They provide important fish habitat and hydrologic functions by controlling floods and erosion. The riparian vegetation functions as a buffer and filter system between upland development and the river, maintaining water quality by absorbing nutrients, accumulating and stabilizing sediments and removing pollutants from upland development. These areas are also where a major part of the Forest sport

fishing and other recreational activities are concentrated. The trampling of soils by anglers, hikers or others using the riparian areas can result in soil compaction, reduction in organic matter and root exposure. User developed trails may also result in collection of surface water, with rutting and erosion. Loss of soils can lead to sediments entering salmon habitat, and result in a reduction in spawning and rearing habitat, negatively affecting spawning gravel quality, or filling in the pools, or loss of undercut banks (Furniss et al. 1991).

Riparian zones, floodplains, and alluvial landforms are probably the most sensitive areas to recreational developments and use. In their review Clark and Gibbons (1991) found that even light recreational use could impact riparian vegetation causing mortality of the over story, loss of tree vigor, root kill, and loss of ground cover. They also indicate that keeping roads and trails away from sensitive areas is important in controlling impacts. Baxter and others (1999) have suggested that alluvial, or floodplain sections of streams are the most critical and sensitive reaches of watersheds. Gunderson (1968) found that floodplain development altered the stream morphology and fish populations. On the Kenai Peninsula, the intensive use of the floodplain has resulted in a decline of chinook habitat capability. Liepetz (1994) evaluated the effects of development and recreational use on the rearing habitat capability on the Kenai River. He found, using juvenile chinook as an indicator, that 11 to 12 percent of the shoreline habitats had been impacted by bank trampling, loss of vegetation, and structure or facilities development. Griglak (2000) also found that, before extensive bank restoration activities starting in 1996, the lower Russian River experienced significant loss of stream bank stability due to recreational angler trampling. Comprehensive rehabilitation efforts on these areas have resulted in an improvement of habitat quality (Griglak 2000).

Access can also play a critical role in determining potential impacts on aquatic habitat by either hindering or facilitating recreational use of the streams and lakes. As previously described, roads may have a detrimental impact on salmon habitat (Furniss et al. 1991). Clark and Gibbons (1991) suggest that access management is critical to protecting the quality of fish habitat. In their review, Clark and Gibbons (1991) state that if roads and trails are kept some distance away from the stream channels, detrimental impacts to habitat may be kept at a minimum. The standards and guidelines for the Revised Forest Plan call for keeping roads and trails out of riparian areas, with incursions into riparian habitat only where necessary to cross from one side of the valley to another, or to direct recreational users to specific spots, such as viewing spots or angler access.

Recreational gold panning that is allowed under most prescriptions also has potential to impact spawning habitats. Some use of motorized suction dredges is allowed within all alternatives. Griffith and Andrews (1981) found that suction dredging stream gravels resulted in destruction of salmonid embryos and alevins within the affected spawning substrate. Roberts and White (1992) indicate that the eggs of alevins are most vulnerable during the second part of their incubation within stream gravels. Harvey and Lisle (1998) in their review of the potential impacts of suction dredging on fish habitat indicated that the impacts go beyond

the direct impacts to incubating salmon eggs. Dredging of stream banks can have long lasting effects on stream channel stability. Dredging within the riffle crests could destabilize spawning sites and reduce the number of aquatic invertebrates. Also, fine sediments are mobilized and may be cast over spawning substrates. Juvenile and adult salmonid are not affected, as they are sufficiently mobile to not be directly impacted.

In response to these potential effects, the standards and guidelines for recreational gold panning include timing restrictions to protect the eggs and alevins in the gravels. The size of dredge equipment is also regulated to limit the amount of gravel that can be processes. The dredging of banks within the active stream channel is prohibited. Motorized dredge equipment is not allowed within Category 1 and Category 2 nonmotorized prescriptions. The Forest is currently directing recreational gold mining into several areas on the Kenai Peninsula. Since not all of the potential impacts can be mitigated there is some potential for damage to salmon habitats. As shown in Table 3-27c, the number of anadromous stream miles open to recreational mining using suction dredge equipment within major placer gold producing areas is a good measure of the intensity of this potential impact.

Table 3-27c: Miles of anadromous streams open to motorized suction dredging.

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Miles	105	37	117	107	42	29	24	27

Intensive recreational fishing sites are not expected to change much between alternatives, but the access to them does. Access decisions may have implications on how people use an area, and subsequently on how much streamside disturbance would occur. As the distance from access points increases, the use of salmon and trout streams decreases. The location of roads and trails near streams could have indirect impacts on aquatic habitat. Alternative B, with emphasis on more summer motorized recreation in the road corridor and in backcountry areas could put more motorized riders in high value fisheries habitat. Damage to streams from anglers trampling banks may be mitigated by restrictive angling regulations.

In their paper, Clark and Gibbons (1991) determined that light use, such as those associated with primitive or semi-primitive ROS classes, results in only minor impact. Still localized impacts can occur, particularly where camp sites, trails and other facilities are located within the riparian areas (Kuska 1977, Settergram 1997). Burns (1991) suggested that small or minor impacts could have cumulative effects on aquatic habitat and organisms.

Given these findings, those alternatives that emphasize primitive and semi-primitive recreation would have less risk of adversely affecting fish and aquatic habitat. Table 3-28 displays the Class I stream miles within each ROS class. The No Action and Preferred Alternatives, as well as Alternatives C, D, E, and F

have nearly all acres allocated to primitive and semi-primitive prescriptions (from 93 to 96 percent).

Table 3-28: Class I stream miles within each ROS class.

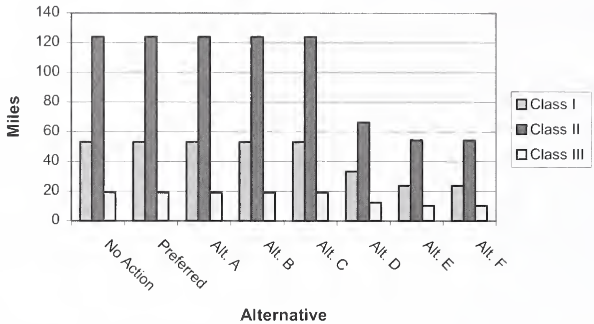
ROS Class	Alternative							
	No Action	Preferred	A	B	C	D	E	F
PI	2	77	2	2	143	315	319	348
PII	209	948	0	0	0	416	819	961
SPNM	1,074	1,351	58	1,251	1,791	1,448	1,131	992
SPM	1,156	79	1,552	486	449	251	182	158
RN	102	82	708	757	151	112	91	84
RM	4	5	187	51	11	4	4	4
R	6	10	45	6	8	6	6	6
Total	**2,552**	**2,552**	**2,552**	**2,552**	**2,552**	**2,552**	**2,552**	**2,552**
% ROS > SP	**96%**	**96%**	**63%**	**68%**	**93%**	**95%**	**96%**	**96%**

Effects from Vegetation Management

Vegetation, and particularly riparian vegetation, regulates the exchange of nutrients and organic material from upland forests and grasslands to streams. Vegetated riparian areas are particularly dynamic portions of the landscape. These areas are shaped by disturbances characteristic of upland ecosystems, such as fire and wind throw, as well as by disturbance processes unique to aquatic systems, such as channel erosion, peak flow, deposition by floods, and debris flows. Riparian areas are widely considered to be critical habitat for fish and aquatic insects. Maintaining the integrity of the vegetation is particularly important for these riparian-dependent species.

The loss of riparian vegetation to spruce bark beetle mortality within the riparian stream areas on the Kenai Peninsula is a management concern. First, after tree mortality, roots will eventually lose their soil holding capability, which could result in bank destabilization. Second, the long-term availability of large woody debris is decreased. Third, the introduction of leaves and needles into streams is disrupted, resulting in lower nutrient input. The riparian zones of the Russian River, Resurrection Creek, Quartz Creek, Bean Creek, and Dave's Creek have all been impacted by spruce bark beetle mortality. The difference in riparian restoration miles is based on the assumption that the Recommended Wilderness Management Area prescription does not allow for vegetation management activities. Figure 3-14 shows estimated miles of Class 1, 2 and 3 streams that would be restored by alternative.

Figure 3-14: Estimated miles of class I, II, and III restoration by alternative.



Effects from Wildlife Management

Generally, wildlife management projects would be expected to improve or have no effect on fish and aquatic insect habitat. Prescribed burning effects on fish habitat are similar to those described under the Fire Management section.

Cumulative Effects

Cumulative effects are similar in all alternatives. New management activities should not cause additional effects on freshwater fish habitat. The majority of the acres on the Forest would be managed through natural disturbance process. Changes to forested cover types, from all activities, ranges from 1.1 to 2.2 percent per decade. Productive habitat would continue to be well-distributed across the Forest. Riparian protection measures in these watersheds would likely mitigate many effects of management activities on the fisheries resource.

The inclusion of large blocks of Category 1 and 2 prescription areas in all alternatives increases the likelihood of maintaining rearing and spawning habitat capability. However, the risk of site-specific adverse effects increases in relation to the miles of roads constructed, acres of commercial timber harvested, and acres of intensive resource development. Risks include the adverse effects of sedimentation from unplanned events such as road failures or washouts of culverts and bridges; the failure of culverts and bridges to pass fish, even though they were designed to so; and, stream bank damage from recreation use. Alternatives A and B, the No Action Alternative, Alternative C, the Preferred Alternative, and Alternatives D, E and F rank in order of overall potential risk to fish.

Generally speaking, alternatives proposing construction or reconstruction of the most new roads would have the highest potential risk of creating adverse cumulative effects to the fisheries resource in watersheds currently rated

sensitive. This would include effects to both Forest and off-Forest streams. Alternative A proposes the most miles of road, followed by the No Action, B, the Preferred, C, D, E, and F.

There may be other contributing factors such as recreational or commercial over harvest, diseases, and hatchery practices that are responsible for fish population fluctuations. For fish species that are subject to exportation, state and federal regulatory mechanisms, such as population objectives, harvest objectives, sustainable yields and lengths and types of harvest seasons, play an important role in population ecology and species distribution across the Forest.

Essential Fish Habitat Summary

Many types of management actions have the potential to affect essential fish habitat. Various conservation measures will be implemented to minimize adverse effects on essential fish habitat, protecting and conserving habitat to support sustainable fisheries and their contributions to healthy ecosystems. These measures include management area prescriptions featuring low impact activities, at the forest plan level, and the implementation of the applicable Best Management Practices and standards and guidelines a the project level. Essential Fish Habitat assessments will be made during project planning and displayed in the project environmental document. Formal and/or informal consultation procedures (as directed by Section 305(b)(2) of the Magnuson-Stevens Fisheries Conservation Management Act, 1996) will be used with the National Marine Fisheries Service on all the projects that implement the Revised Forest Plan that potentially affect essential fish habitat.

We have concluded that the likelihood of Chugach National Forest resource management activities affecting the habitat needed for sustainable fisheries is low. Riparian and aquatic habitats are protected in all activities that have potential to affect fish habitat through the application of Regional and Forest aquatic ecosystem protection standards and Best Management Practices. Therefore, activities associated with implementation of the Preferred Alternative are expected to have minimal if any effect on essential fish habitat.

Fire Management

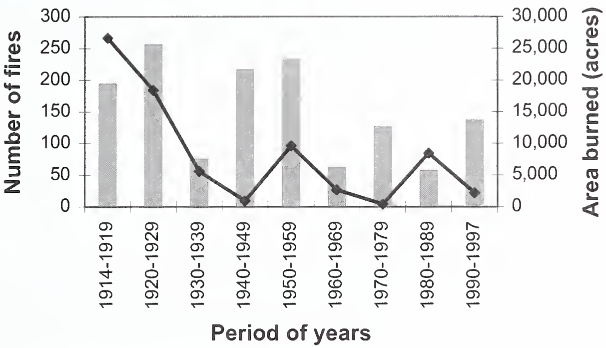
Introduction

Although the climate is generally not conducive to natural fire ignition (e.g., lightning strikes are rare), wildland fire has been an important influence on the Kenai Peninsula portion of the Chugach National Forest (Potkin 1997). The present landscape reflects human-caused fires that have occurred over the last 100 years or so, creating areas of early successional plant communities, which include large stands of broadleaved forests. These fires have generally increased the richness and patchiness of the vegetation at a landscape level.

The fire history of the area is described in three distinct periods – prehistoric (pre 1740), settlement (1741-1913), and post settlement (1914-1999). Fire has contributed to the landscape diversity most recently in the settlement and post settlement periods and periodically for the last several thousand years. Radiocarbon dates of five charcoal samples from soils at scattered locations in the Kenai Mountains ranged from 3,010 to 570 years before present with an average of 600 years between dates (Potkin 1997). Charcoal has been reported as present in most soil pits within the forested zone in the Kenai Mountains (Davidson personal communication). This anecdotal evidence suggests the occurrence of widespread, yet infrequent, fires in prehistoric times.

Prior to the settlement period of the late 1800s, the majority of the age structures of the coniferous forest surveyed were likely in late successional stages (Langille 1904) and conifers were likely dominant (Potkin 1997). If mature coniferous forests were dominant prior to the settlement period, the vegetation community diversity on the Kenai Peninsula was lower at that time and increased in the late 1800s and early 1900s, during a period of major fire occurrences. The fire history of the Kenai Peninsula includes infrequent, but large fires (Vanderlinden 1991). Figure 3-15a shows that about 1,400 fires have burned a combined 75,000 acres on the Kenai Peninsula portion of the Forest from 1914 to 1997 (Potkin 1997). Human-caused ignitions account for over 99 percent of these fires. The majority of fires have occurred in grassland vegetation types in the early fire season, from mid-April through June, with some activity in August and September.

Figure 3-15a: Fire history of National Forest lands on the Kenai Peninsula from 1914 to 1997 as indicated by the number of fires and acres burned by decade.



Source: Potkin 1997.

Today, fires generally fall into two categories: wildland fires and prescribed fires. A wildland fire is a fire resulting from an unplanned ignition. It requires an appropriate response to control its spread. A prescribed fire is a fire ignited by management actions to meet specific objectives, such as to reduce hazardous forest fuels or improve wildlife habitat.

Legal and Administrative Framework

- The **Organic Administration Act of 1897** authorizes the Secretary of Agriculture to make provisions for the protection of national forests against destruction by fire.
- The **Bankhead-Jones Tenant Act of 1937** authorizes and directs the Secretary of Agriculture to develop a program of land conservation and land utilization to protect public lands.
- The **Wilderness Act of 1964** authorizes the Secretary of Agriculture to take such measures as may be necessary in the control of fires within designated Wilderness while letting fire play a more natural role.
- The **National Forest Management Act of 1976 (NFMA)** directs the Secretary of Agriculture to specify guidelines for land management plans to ensure protection of forest resources.
- The **Clean Air Act of 1977** provides for the protection and enhancement of the nation's air resources.

- **Alaska Department of Environmental Conservation – 18 AAC 50 – Air Quality Control -** These are the air quality control regulations for the State of Alaska. The Chugach National Forest abides by the provisions of these regulations. The regulations set ambient air quality standards for the State of Alaska (for eight contaminants), as well as allowable maximum increases to air quality. Controlled burns greater than 40 acres require an ADEC permit.

Key Indicators

- Acres of fuels treated adjacent to communities, roads, trails, waterways, and other developed sites

Resource Protection Measures

Protection of life and property from the threat of wildland fire is one of the Forest's most critical missions. To accomplish this protection in the most cost effective manner, the State of Alaska has been divided into a series of four protection zones as outlined in the Alaska Wildland Fire Management Plan (1998).

Alaska is unique nationally by having developed one interagency fire plan across all land ownerships. The fire plan prioritizes areas according to fire protection levels based upon natural terrain, vegetative changes or values at risk, rather than changes in ownership. This recognizes the natural role of fire in the landscape, changing vegetative patterns that benefit wildlife and as a source of regeneration for some species such as black spruce. Interagency fire planning, involving all landowners and managers, defined four fire suppression protection levels. Prioritization of fire fighting forces can be based on the highest to lower protection levels.

The four protection levels are:

Critical Protection: Areas given this level of protection are those in which wildland fires would threaten human life, inhabited property and designated development. Wildfires that threaten a critical site have unquestioned priority over all other fires. The designation of a critical site or area is at the discretion of the land manager or owner and the manager/owner of surrounding lands.

Full Protection: Areas assigned this designation receive initial attack and aggressive suppression efforts on all fires until controlled. This option is designed to protect historical sites, uninhabited private property, high-value natural resources and other high value areas that do not involve protecting human life and inhabited property.

Modified Protection: The intent of this option is to reduce suppression costs and impacts of suppression action and to provide land managers/owners options within agency constraints and mandates. It allows for two responses to fire:

1. A relatively high level of protection during seasonal periods when fires usually burn with greater intensity, severity and frequency; and
2. A lower level of protection when the risks are large, damaging fires has diminished.

Limited Protection: This category is characterized by areas with low values at risk, where the impact of suppression may be more damaging or costly than the effect of fire. Suppression actions are taken only to the extent necessary to keep a fire within the management unit or to protect identified values. Site-specific areas that warrant protection may occur within limited protection areas. Appropriate suppression actions to protect these sites may be taken without compromising the intent of the limited protection areas.

An environmental analysis is used to determine the correct process to treat either active or natural fuel accumulations. If treatment by using a prescribed fire is desired, a burn plan is prepared to address the objectives of the environmental analysis. The burn plan addresses the correct method of applying fire while considering items such as air quality, protection of heritage resources, resource objectives, and public safety.

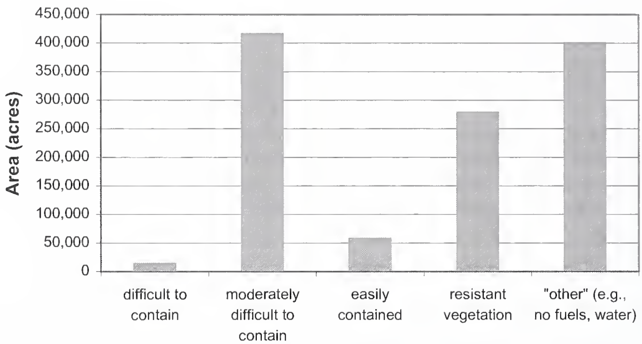
Affected Environment

Fuels

Eight fuel models are used to describe the forest fuels on the Kenai Peninsula (USDA Forest Service 1978, 1999a). The fuel models speak to the difficulty to contain fires. Current fuel loading data indicates increased chances for large stand replacement fires, with over 40,000 acres classified in the moderately difficult to contain fuel model class (Figure 3-15b). The major concern is that there are 1.3 million acres of dead trees on the Kenai Peninsula resulting from a spruce bark beetle outbreak since 1987. After a spruce bark beetle outbreak, grass and other fine vegetation generally increases (Holsten et al. 1994). Fire spreads rapidly through this vegetation type. As the spruce trees break or blow down over the next 5 to 20 years, large woody debris begins to accumulate on the forest floor. Monitoring in Resurrection Creek indicates a change from 0.32 tons per acre of 3-inch material to 23.16 tons per acre following the beetle infestation (USDA Forest Service 1995b). This wood is the largest component of the fuels complex. Heavy fuels are more difficult to ignite, but once lighted they burn at higher intensities and for longer duration. The combination of fine, flashy fuels and abundant large woody debris creates a hazardous fuels situation. The

high probability of human-caused ignitions (see Figure 3-15a) and the fact that over 32,000 acres of spruce bark beetle-infested stands with 70 percent or greater spruce mortality are within one mile of an existing roads and trails suggest a risk of large-scale fire occurrences on the Forest (DeLapp et al. 2000).

Figure 3-15b: Area by fuels model class on the Kenai Peninsula portion of the Chugach National Forest.



Source: Chugach National Forest GIS corporate database.

Wildland Fire

The Chugach National Forest is generally in a low-frequency/high intensity fire regime. From 1914 to 1999 approximately 1,420 fires burned a total of 75,000 acres within the Forest Boundary (Figure 3-15a). This is an average of about 16 fires each year. The average size of the fires was about 50 acres. About 75 percent of the fires have been less than a ¼ acre. Only two fires have been greater than 1,000 acres. Over 99 percent of all the acres burned were on the Kenai Peninsula. Humans caused over 99 percent of the fires. In the last 25 years, campfires account for over 50 percent of all wildland fires on the Forest. During the last decade, there have been 145 fires on the Forest. They have burned an average of 15 acres per year.

Prescribed Fire

Prescribed fire is used to meet management objectives, such as removing hazard trees, reducing hazardous fuels, reducing slash from timber harvest, improving wildlife habitat, and improving biological diversity. For a prescribed fire, a plan will be written and approved and NEPA requirements met before the burn is initiated. Currently, the Forest has a hazardous fuel-burning target of about 200 acres per year. Prescribed fire acreage will need to be increased over

the next 5 – 10 years in order to accomplish hazardous fuel reduction objectives. The location and timing of any prescribed fire will be decided on a site-specific basis after an analysis that includes fire hazard, fire risk, resource values and appropriate management area prescriptions applied to the land in the preferred alternative.

Environmental Consequences

General Effects

Fire hazards are greatest in older timber stands where an accumulation of ground fuels has occurred. The percentage of forestlands in mature condition is projected to increase under all alternatives.

In addition to fire hazard, the risk of ignition must be considered. The majority of ignitions are associated with humans and their activities (camping, hunting, etc.). There is no specific pattern to lightning ignitions. The risk of human-caused fires varies among the alternatives. As the level of human activity (primarily associated with transportation routes) increases, so does the risk of a human-caused fire. The No Action Alternative and Alternatives A and B have the greatest risk. The Preferred Alternative and Alternatives C, D, E, and F have the least risk.

Values are key in a description of the Forest fuel/fire situation. Urban interface zones, regenerated stands, unique habitats, domestic watersheds, and highway (visual) corridors are a few examples of high or moderate resource values. Other areas would have low or moderate resource values. The wildland fire management strategy or strategies are established for each management area in the Alaska Wildland Fire Management Plan (1998).

Direct and Indirect Effects

Wildland fire initial attack suppression efforts do not vary by alternative. Protection of life and property has the highest priority. Table 3-29 shows the fuel treatment program for the Forest, by alternative. Most all of this work would be accomplished by burning.

Table 3-29: Fuels reduction program.

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Fuels reduction (acres/year)	400	400	400	400	400	400	400	400

Based on the analysis in the “Kenai Peninsula Spruce Bark Beetle Management Strategies & Five-Year Action Schedule”, all alternatives, including the Preferred, would treat 400 acres of vegetation per year with prescribed fire to reduce fuel buildups (USDA Forest Service 1999a). This in turn could lessen the intensity and rate of spread of a wildland fire.

The Kenai Peninsula is the area of primary concern on the Chugach because of the proximity of people and communities to hazardous fuels. A full range of fuels treatment activities are allowed or conditionally allowed on all lands on the Kenai Peninsula. This includes prescribed fire, mechanical timber stand thinning and tractor piling. The following prescriptions are applied to areas where hazardous fuels may be treated on the Kenai Peninsula: Backcountry (211); Backcountry Motorized (212); Scenic River (231); Brown Bear Core Area (242); Fish and Wildlife Conservation Area (244); Fish, Wildlife and Recreation (312); Forest Restoration (314); Recreational River (331); Developed Recreation / Reduced Noise (341); Resource Development (411); and, Developed Recreation Complexes (441). Some prescriptions prohibit road construction, reconstruction, and scheduled commercial timber harvest. However, mechanical methods of fuels treatment are allowed or conditionally allowed on all lands on the Kenai Peninsula.

Effects from Timber Harvest

Timber harvest activities generally reduce the natural fuel loadings. As the forest ages and moves into late successional stages, fuel loading increases. Timber harvest moves the forest into earlier seral stages, generally reducing the fuel loading. Timber harvest activities that create large canopy openings can also reduce the potential for fires that move through the crowns of trees, independent of surface fuels. Only the No Action Alternative and Alternatives A and B would have scheduled commercial timber harvest. Harvest under all other alternative would be limited to firewood and hazard tree removal.

Slash or activity fuels would be created through timber harvest. The timber purchaser would be required to follow State of Alaska fire regulations and would be prepared to suppress any fires within the contract area. The timber purchaser would be required to treat logging slash to reduce the threat of a high intensity wildland fire. This would greatly reduce the buildup of slash and the risk of fire. Timber harvest contract provisions also require timber purchasers to conduct their operation using fire precautionary measures. Personal use timber extraction usually leaves the slash scattered on the forest floor. This could increase the fire hazard. General statements about fuel levels in stands receiving timber harvest treatment versus fuel levels in untreated stands cannot be made. The situation depends greatly on the type of timber harvest treatment and the amount of slash disposal prescribed for the harvest area.

Effects from Recreation

Recreation use of the Forest is expected to increase under all alternatives. With an increase in the number of people using the Forest, the risk of human-caused wildland fires increases. Management of vegetation near communities, public concentration areas and transportation routes would help reduce the threat of fire to life and property.

Cumulative Effects

Vegetation changes on the 1.3 million acre Kenai Peninsula due to the spruce bark beetle infestation would have an impact on wildland fire suppression efforts

over time. Observations from recent fires on the Kenai Peninsula have shown an increase in crown fires. During the first three years after attack, beetle infested areas will become a higher fire threat when the needles turn red. After the needles drop off, the areas become a much lower threat than under a live tree situation. Several years after the needles drop, the areas will once again have an increased level of threat related to the invasion of blue-joint reedgrass (*Calamagrostis canadensis* (Michx.) Beau). The threat is not from a long duration ground fire/crown fire, but comes from a very fast spreading ground fire. After approximately 15 years the threat would be from the fast moving grass type fire and very limited access because the dead trees would be falling down.

Generally, a very large wildland fire on the Kenai Peninsula could occur under prolonged low humidity with little or no nighttime humidity recovery and increased winds coupled with a continuous fuels. However, weather conditions are variable and large fires are possible in these stands with fewer extremes in weather conditions. Large fires in proximity to human activities pose a threat to life and property. The vegetative mix where a fire could occur would dictate the level of resistance to suppression efforts.

The majority of wildland fires on the Chugach National Forest occur near communities, public concentration areas (e.g., campgrounds), along roads, trails, and waterways as a result of the human activities. When the fuel source is located in key areas (communities, public concentration areas, roads, trails, and waterways) and humans are present the probability of a wildland fire increases. A fire protection analysis has been completed for the Kenai Peninsula, which considers an assessment of fuel conditions, values at risk and the potential for human presence. The rest of the Chugach will be covered by a protection analysis at a later date, because the weather conditions are somewhat more humid and the risk of a wildland fire is lower.

Vegetation treatments (tree removal, mechanical manipulation or prescribed fire) and keeping those fuel levels lower over time afford the best opportunities to reduce the potential hazards of human-caused wildland fire. As rural development occurs in areas bordering the Forest, emphasis will need to be placed on reducing hazard fuels adjacent to these developments.

The risk of human-caused fires would increase under all alternatives due to projected increases in Forest visitor use. The risk of fires from lightning would remain constant under all alternatives. In alternatives where people can go more places (roads and trails), there are more locations that would be placed at risk, as human activities are a primary ignition source. In alternatives with less motorized access to the Forest, the risk of wildland fire would decrease. Fire prevention and enforcement can reduce the threat of human caused fire. Alternatives that retain roadless lands by limiting access or by removing direct treatment techniques such as timber harvest and thinning would have incremental negative cumulative effects.

Insects and Diseases

Introduction

Insects, diseases, and related decay processes are an integral and natural part of forest ecosystems. These disturbances play an important role in shaping forest composition, structure, and development. They are fairly widespread over the Forest and act over long periods of time. During periods of epidemic levels, however, dramatic and rapid forest change can occur.

Insect and disease-caused stresses influence species composition, diversity, density, nutrient cycling, and plant succession (Zasada et al. 1977). There is a large body of work describing the spruce bark beetle outbreak on the Kenai Peninsula, with aerial survey data dating from 1957 to today. Monitoring plots have been in place for over 20 year (Werner and Holsten 1983). Surveys in 1996 estimated that over 1,125,000 acres of forested land in Alaska were infested with spruce beetle and that on the Kenai Peninsula alone over 840,000 acres of spruce mortality has occurred since 1989 (Holsten and Burnside 1997).

Insects and disease, along with wildland fire, have been viewed as having negative influences on the Forest. This will still be the case where management objectives conflict with insect and disease outbreaks. However, where management objectives accept the impacts from these outbreaks as being part of the natural disturbance processes in the Forest, they are considered to be beneficial to the Forest's cycles of growth and decline and necessary to the maintenance of the Forest.

The long-range goal of insect and disease management is prevention and suppression through silvicultural treatment of susceptible stands. Control of insects and diseases on the Chugach Forest has been limited to the Kenai Peninsula in response to the on-going spruce beetle epidemic and has occurred primarily by salvage harvest of dead and dying trees and sanitation harvest to suppress damaging levels of insect and disease populations. However, these techniques are reactive, not proactive, and have done little to slow or suppress spruce bark beetle population levels. Pesticide treatment can reduce spruce beetles in high value areas such as campgrounds and administrative sites.

Since 1987, intensive spruce beetle suppression and salvage treatments have occurred in almost all the Forest's campgrounds on the Kenai Peninsula, some recreation trail corridors and trailheads, and in some stands with high levels of dispersed recreation or importance to wildlife along the Kenai River.

Stand management is now regarded as a way to develop stands that are much more resistant to attacks by insects and disease. In general, management activities that increase stand vigor will usually decrease stand susceptibility to insects or disease. The amount of forested land that may be susceptible to insects and disease may be related to the presence or absence of management.

Legal and Administrative Framework

- **36 CFR 219.16(a)(2)(iii)** – This regulation allows for the harvesting of stands of timber that have not reached CMAI (culmination of mean annual increment) which are in imminent danger from insect or disease attack.
- **36 CFR 219.27**– This section of the regulations sets the minimum specific management requirements to be met in accomplishing goals and objectives for the National Forest System. 36 CFR 219.27(a)(3) requires that all management prescriptions utilize principles of integrated pest management to prevent or reduce serious, long lasting hazards and damage from pest organisms, consistent with the relative resource values involved. 39 CFR 219.27(c) discusses the ASQ (allowable sale quantity) and states: "Nothing in this paragraph prohibits salvage or sanitation harvesting of timber stands which are substantially damaged by fire, windthrow, or other catastrophe, or which are in imminent danger of insect or disease attack and where such harvests are consistent with silvicultural and environmental standards."

Key Indicators

- Acres infested with spruce beetles (Kenai Peninsula)
- Acres of management area prescriptions in which vegetation or timber management is emphasized
- Acres of proposed vegetation and timber management activity

Resource Protection Measures

Resource protection is accomplished through Forestwide and management area prescription standards and guidelines. Sanitation and salvage sales may be used to suppress insect and disease activity where necessary and allowed.

Affected Environment

While there are numerous insects and disease species on the Forest, only those pest species that are considered to be a management concern are discussed below.

Insects

White spruce (*Picea glauca* (Moench) Voss) and Sitka spruce (*Picea sitchensis* (Bong.) Carr.) are affected primarily by spruce beetle while western and mountain hemlock are affected primarily by black-headed budworm.

<u>Spruce Bark Beetle</u> – Spruce beetles are a permanent resident of spruce forests and are one of the most important disturbance agents in mature white spruce stands in Southcentral and Interior Alaska.

As in Southeast Alaska, outbreaks in the Southcentral Alaska coastal forests of Prince William Sound and Copper River Delta are generally smaller and of shorter duration than outbreaks in the forests of the Kenai Peninsula and Interior Alaska, which are larger and of longer duration.

The spruce beetle responds quickly to large-scale blowdown of spruce trees from wind, fire-scorched trees, spruce injured by flooding, or in residual (cull) logs left after land clearing or timber harvest. Large numbers of beetles can be produced in such breeding material, leading to potential outbreaks that spread into adjacent standing trees. Weather conditions appear to play a role in the expansion or contraction of beetle populations. Extensive, dense, stands of even-aged spruce trees are at greater risk of large-scale epidemics compared to more diverse forested areas containing a mixture of cover types and structural stages (between stands or within stands).

Spruce beetle populations in Prince William Sound and Copper River Delta are endemic in nature, while over the last two decades the spruce beetles have been at epidemic levels on the Kenai Peninsula and the rest of Southcentral Alaska killing several million acres of mature spruce forest.

The estimated acreage affected by the spruce beetle epidemic on the Kenai Peninsula portion of the Forest is displayed in Table 3-30.

Table 3-30: Estimated acreage impacts of spruce beetle on the Kenai Peninsula, Chugach National Forest.

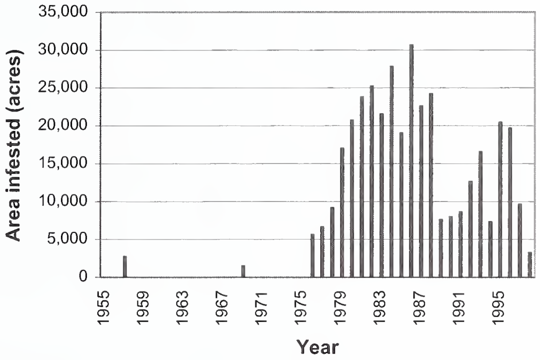
National Forest System land on the Kenai Peninsula	Total Acres	Percent Of Total Acres	Percent of Total Spruce Beetle Infested Acres	Percent of Total Spruce Beetle Infested Acres with 70+ Percent Mortality
Forested land	217,060	100		
Spruce beetle infested since late 1950s	69,000	32	100	
Spruce beetle infested since late 1950s with 70+ percent mortality in spruce	39,000	18	57	100
Spruce beetle infested since late 1950s with 70+ percent mortality in spruce and located with one mile or less of existing roads	15,400	7	22	40
Spruce beetle infested since late 1950s with 70+ percent mortality in spruce and located within one mile or less of existing roads and trails	32,000	15	46	82

Source: USDA Forest Service 1999g.

The spruce beetle infestation on the Kenai portion of the Forest began in the late 1950s and grew at an unprecedented level during the 1980s (Figure 3-16). Management actions to address the beetle infestation has taken place on almost 12,500 acres since 1981, with 59 percent treated by prescribed fire, 37 percent by timber harvest, and 4 percent by timber stand improvement (USDA Forest Service 1999a). There is widespread concern that fire hazard will increase as a result of beetle infestations. Since the beetle outbreak, large woody debris has

accumulated and there has been an increase in grass and other fine vegetation ground cover through which fire spreads rapidly.

Figure 3-16: Spruce bark beetle infestation acreage on the Kenai Peninsula portion of the Chugach National Forest for the years 1957, 1969, and 1976 through 1998.



Source: Chugach National Forest GIS corporate database.

Black-Headed Budworm, (*Acleris gloverana* (Wals)). The black-headed budworm is native to the forests of coastal and southwestern Alaska and is one of the more destructive insects in these forests (Mask 1992). It occurs primarily in Southeast Alaska but in 1996 and 1997, approximately 30,000 acres of defoliation were observed in Prince William Sound and about 1,000 acres on the Kenai Peninsula.

Budworm larva feeding strips hemlock foliage and can cause growth reduction, top-kill, and at times, tree mortality. Localized outbreaks continue to occur throughout the coastal hemlock type in Prince William Sound and Copper River Delta. Budworm populations in Alaska have been cyclic, arising quickly, impacting vast areas, and then subsiding within a few years.

Northern Spruce Engraver (*Ips perturbatus* Eichhoff) – The northern spruce engraver is killing mature as well as pole-sized spruce on the Kenai portion of the Chugach National Forest (Holsten 1998). In addition to standing trees, cut or fallen trees are attacked. Engravers prefer sunnier and drier host material than do spruce beetles (Holsten et al. 1980). Prevention is perhaps the best suppression measure. Preventing slash accumulation, burning infested material, or scattering slash in very sunny locations helps reduce northern spruce engraver buildup (Holsten et al. 1980).

The combined effects of the spruce beetle and northern spruce engraver may increase with the apparent warming trend occurring throughout Alaska (Berg and DeVolder 2001).

Diseases

Diseases are chronic factors that significantly influence the commercial value of the timber resource and alter key ecological processes including forest structure, composition, and succession. The presence of disease in recreation areas can also cause tree failures, which can pose serious safety and liability problems.

At the Forestwide level, the extent and location of diseases is unknown and unmapped. However, disease is a factor in the development of silvicultural prescriptions for project level management activities.

Wood decay fungi decompose branches, roots, and boles of dead trees; therefore, they play an essential role in recycling wood in forests. However, sap rot decay also routinely and quickly develops in spruce trees attacked by spruce beetles. Large amounts of potentially recoverable timber volume are lost annually due to sap rot fungi on the Kenai Peninsula, where salvage logging has not kept pace with tree mortality from the continuing spruce beetle epidemic. Significant volume loss from sap rot fungi typically occurs several years after tree death. The most common sap rot fungus associated with spruce beetle-caused mortality is *Fomitopsis pinicola*, the red belt fungus.

In Southcentral and Interior Alaska, heart, butt, and root rot fungi (Table 3-31) cause considerable volume loss in white spruce forests.

Table 3-31: Common wood decay organisms of live trees in Alaska and tree species infected.

	TREE SPECIES INFECTED			
Heart, butt, root rot fungi*	**Western hemlock**	**Mountain hemlock**	**Sitka spruce**	**White/Lutz spruce**
Laetiporus sulphureus	X	X	X	X
Phaeolus schweinitzii	X		X	X
Fomitopsis pinicola	X	X	X	X
Phellinus hartigii	X			
Phellinus pini	X	X	X	X
Ganoderma sp.	X		X	X
Armillaria sp.	X	X	X	X
Inonotus tomentosus				X
Heterobasidion annosum	X		X	
Echinodontium tinctorium		X		

* Some root rot fungi were included in this table because they are capable of causing both root and butt rot of conifers.

In the coastal forests of Southeast Alaska, approximately 1/3 of the old-growth timber volume is defective largely due to heart rot fungi. While no studies have been conducted in the old-growth forests of Prince William Sound or Copper River Delta, one could reasonably expect the same level of volume loss to heart rot fungi in these coastal forests of the Forest. Stem decay is the most important cause of volume loss and reduced wood quality in Alaskan hardwood species. In Southcentral Alaska, incidence of stem decay fungi increases with stand age and is generally high in stands over 100 years old. External decay indicators, such as conks, frost cracks, wounds, and broken branches are frequently seen on live

trees with internal decay. There are many stem decay organisms of hardwoods in Alaska, however *Phellinus igniarius* and *Phellius tremulae* are the most common decay fungi of paper birch and aspen, respectively.

Tomentosus root disease (*Inonotus tomentosus* (Fr.) Teng.) is a fungus that causes root and butt-rot of white, Lutz, and Sitka spruce in Southcentral and Interior Alaska. Spruce trees of all ages are susceptible to infection through contact with infected roots. Infected trees exhibit growth reduction or mortality depending on age. In young growth managed stands, planted spruce seedlings may become infected if planted to close to infected root systems of harvested trees (USDA Forest Service and State of Alaska 1999).

Future Trends – Spruce beetle populations on the Kenai Peninsula have been declining since 1996 (Figure 3-15b). Many previous areas of active beetle infestations have been reduced as essentially all available host trees have been killed. Overall, active infestation areas on the Forest have declined by over 50 percent for the second year in a row (USDA Forest Service and State of Alaska 2000) and this trend is expected to continue.

Continued, smaller-scale activity can be expected to persist in areas where suitable host material remains or where new areas of disturbance present beetles with the opportunity for development. Active infestations were recorded in 1999 aerial surveys in the vicinity of Trail Lakes, Granite Creek and along the Sixmile River.

In the future, the greatest potential forest insect and disease effects are likely to be in mature and over mature stands where disease levels are high. Tree vigor tends to decrease with maturity, causing an increase in susceptibility to insects and diseases. Heart rot levels are directly proportional to both tree and stand ages. The spruce beetle has the potential to significantly alter stand structure in certain locations. Stem and root decay have historically increased with intensified land management activities, particularly under harvesting systems other than clearcutting. The adverse effects of these forest insects and diseases, at least in part, can be mitigated through silvicultural treatments.

Methodology and Scientific Accuracy - Pest activity is typically detected during on-the-ground activities, or during annual aerial surveys conducted by the region's Forest Health Protection group. The timing of surveys coincides with foliage and pest development. Pest activity noted during surveys is documented and reported to the appropriate land manager. In cooperation with land managers, Forest Health Protection people conduct on-site investigations to verify the pest, to evaluate the pest and its host(s), and to formulate future management alternatives. Often, pest and host monitoring is required to fully understand potential impacts prior to development of management alternatives.

Environmental Consequences

General Effects

The emphasis on management activities to prevent and reduce pest populations or to restore areas already impacted by pest populations varies by alternative. Such emphasis may correspond directly to the proposed levels of vegetation or timber harvesting activities that promote greater habitat diversity. While individually, these management activities may reduce insect and disease in individual stands, it is the cumulative amount of management activity over time on a landscape or the lack thereof, that will determine an alternative's effectiveness.

In general, alternatives that favor low amounts of vegetation or timber management would tend to perpetuate higher levels of susceptibility to insect and disease outbreaks in late successional forests. Ecological processes and late successional wildlife habitat would be maximized, but so would the continued loss of timber, primarily due to high levels of heart rot and on the Kenai Peninsula, spruce beetle. Higher amounts of vegetation management and/or timber harvest would generally yield young stands with little significant insect and disease activity.

In general, endemic levels of insect and disease activity in mature and over mature forests would be allowed to run their course. Timber losses would be acceptable yet harvesting flexibility would be maintained to take advantage of timber salvage opportunities, particularly for dead and dying spruce stands.

Insect and disease suppression may be justified in high quality, mature to over mature stands that cannot be salvaged immediately, or that lie in or near recreation areas and communities where scenic values are high.

Alternatives that increase the amount, extent, or density of mature and over-mature Sitka, white, and Lutz spruce on the Kenai Peninsula would result in increased risk of attack by the major disturbance agent on the Forest, spruce beetles. Tree mortality caused by large-scale outbreaks of insects and disease reduces timber yields, and changes stand structure, species composition, and successional trends. Such changes can enhance diversity by encouraging other plant species, such as paper birch and aspen, and promoting a greater mix of age and size classes; however, the result may not advance efficient timber production goals. Additional effects of widespread tree mortality due to insect and disease activity may include increases in fire hazard, stream flow, and herbage production.

In contrast, alternatives that decrease the amount, extent or density of mature and over-mature Sitka, white, and Lutz spruce on the Kenai Peninsula generally reduce risk of widespread tree mortality caused by insect and disease agents.

Older hardwood stands, especially birch and aspen, currently tend to be heavily diseased, due in part, to the advanced age of many of the trees. Emphasis on enhancing or regenerating hardwood stands could result in more vigorous

vegetation as younger trees vegetate new areas and replace decadent trees, where an emphasis on retaining existing vegetation may perpetuate or increase disease populations.

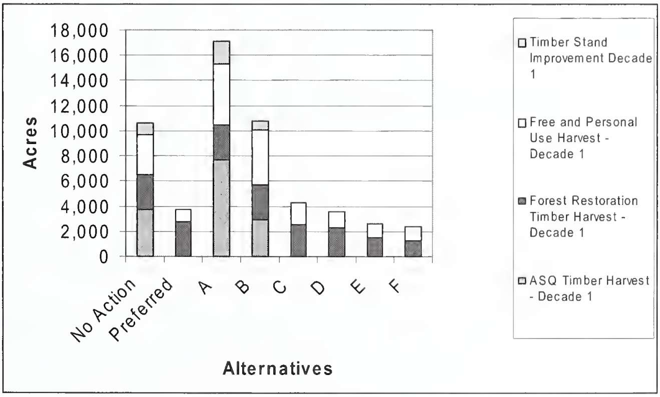
Direct and Indirect Effects

Effects on Insect and Disease Pests from Timber Management

Timber harvesting and timber stand improvement provides an opportunity to implement an ecological approach for the prevention or reduction of serious pest outbreaks. On clearcuts and other final harvest sites, opportunities for long-term protection and prevention of insect and disease outbreaks and restoration of forest health can be managed. Stands most susceptible to insect damage or most infested or infected with disease can be harvested and replaced with young stands that are much less susceptible. In stands scheduled for uneven-aged management, individual suppressed or dying trees can be removed, thus increasing the overall growth and vigor of remaining trees. In commercial or pre-commercial thinnings, susceptibility to insects and diseases may be reduced by increasing the growth and vigor of the remaining trees.

Figure 3-17a shows the cumulative acres that would be treated by timber harvest or stand improvement activities by alternative in the first decade.

Figure 3-17a: Cumulative acres of proposed timber harvest and stand improvement - decade 1.



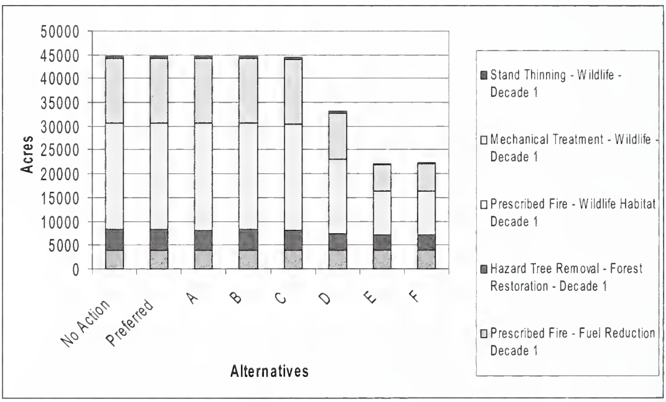
All alternatives may decrease insect and disease risk at the individual treated stand level. At the landscape level, alternatives that reduce insect and disease risk on the greatest acreage over time would be considered most beneficial. Ranking the alternatives by the acreage of proposed treatment, Alternative A is highest, followed by B, the No Action, C, the Preferred, D, E, and F.

Effects on Insect and Disease Pests from Vegetation Management
Vegetation management can alter both cover type composition and/or structural stage by removing, leaving, or regenerating trees during/after prescribed burning, hazard tree removal, stand thinning, timber harvest, site preparation, and reforestation treatments for fuel reduction, wildlife habitat improvement, insect and disease suppression, forest restoration, recreation or visual resource objectives.

Alternatives that decrease the amount, extent or density of mature and over-mature stands on the Kenai Peninsula generally reduce risk of widespread tree mortality caused by insect or disease pests.

Figure 3-17b shows the cumulative acreage of vegetation that would be treated by activities under the fuels, wildlife, and forest restoration programs by alternative in the first decade.

Figure 3-17b: Cumulative acres of vegetation treated by fuels, wildlife, and forest restoration programs - decade 1.



All alternatives may decrease insect and disease risk in stands treated. At landscape scales, alternatives that reduce insect and disease risk on the greatest acreage would be considered most beneficial. Ranking the alternatives by the amount of treated acres, the No Action, the Preferred, A, B and C all provide the highest level of vegetation treatment and would be most beneficial. The remaining alternatives rank D, F and E with E being the least beneficial.

Effects on Insect and Disease Pests from Administrative Site Management
Costs may be higher than for general forest areas to ensure that vegetation surrounding administrative sites is not degraded due to the activity of insects and disease; however, this would not vary by alternative.

Effects on Insect and Disease Pests from Fire and Fuel Management

In all alternatives, there is an emphasis on fire prevention and suppression in high value timber stands; therefore, their effects on pest populations are not likely to vary significantly between alternatives. The effects of large, high intensity wildland fires on forest pests would likely be to reduce or eliminate those that exist in the affected area, including spruce beetle and possible root rot fungi. Lower burning intensities associated with most wildland fires and prescribed burns can weaken the resistance of trees to pest attacks by damaging root systems and cambrial tissues, and might affect levels of root disease and other soil-inhabiting fungi.

In recommended or designated Wilderness, future decisions may allow wildland fires to have a more natural role. This would decrease the susceptibility of older stands to insects and disease. However, decisions will be made on a case-by-case basis.

The proposed fuels reduction program is the same in all alternatives (see Table 3-29) and, therefore, the effects on insect and disease are expected to the same under all alternatives.

Effects on Insect and Disease Pests from Recreation Management

Alternatives emphasizing the creation of more natural settings and older stands for recreation opportunities or conservation objectives would result in Forest conditions susceptible to certain forest pests, especially spruce beetle.

Management area prescriptions that emphasize wilderness, backcountry recreation, and conservation would have little or no management activity for prevention or reduction of insect and disease pests. Relative rank of alternatives follows the same general order as total number of acres included in the specified management areas. The ability to prevent or mitigate pest epidemics in remote, roadless areas would be difficult.

Pest management activities would be continued or intensified under all alternatives to protect developed recreation complexes and sites. Prudent use of pesticides in high value areas can protect trees from beetle attack and preserve the pleasing setting visitors seek and enjoy. Costs may be higher than for general forest areas to ensure that vegetation in and around developed recreation areas is not degraded or causing a safety hazard due to the activity of insects and diseases. However, this should not vary substantially by alternative.

Effects on Insect and Disease Pests from Riparian Area and Wetland Management

Restrictions on use of pesticides near water may limit some pest management options; however, no significant impacts on pest management in riparian areas or wetlands exist under any of the alternatives. Cost of pest management activities may be higher in riparian areas and wetlands because of more restrictive application requirements. Riparian restoration objectives when implemented under all alternatives may eventually reduce incidence of some insect and disease pests.

Effects on Insect and Disease Pests from Travel Management
The extent of road systems in each alternative determines the ability to access areas where pest populations may be approaching destructive levels or to restore areas already impacted. Alternatives providing the greatest amount of road access generally provide the greatest potential to access and treat acres where pest problems exist. Alternative A, the No Action Alternative and Alternative B provide the highest levels of road access, respectively, while Alternatives C and D, the Preferred Alternative, and Alternatives E and F provide decreasing levels of road access, respectively.

Effects on Insect and Disease Pests from Wildlife Habitat Management
Wildlife management varies by alternative. Prescribed fire would be the primary tool used to create early successional habitat for a number of species on the Kenai Peninsula. Fires may increase vegetative diversity, thereby reducing susceptibility of forest vegetation to insects and disease. Cumulatively, wildlife habitat treatments would treat the largest acreage of mature and over mature forest on the Forest and thus would have the largest impact at the landscape-level in reducing susceptibility to insect and disease pests. See Figure 3-13 for proposed wildlife treatment acreage.

All alternatives may decrease insect and disease risk in stands treated. At landscape scales, alternatives that reduce insect and disease risk on the greatest acreage would be considered most beneficial. Ranking the alternatives by the amount of treated acres, the No Action, the Preferred, A, B and C all provide the highest level of vegetation treatment and would be most beneficial. The remaining alternatives rank D, F and E with E being the least beneficial.

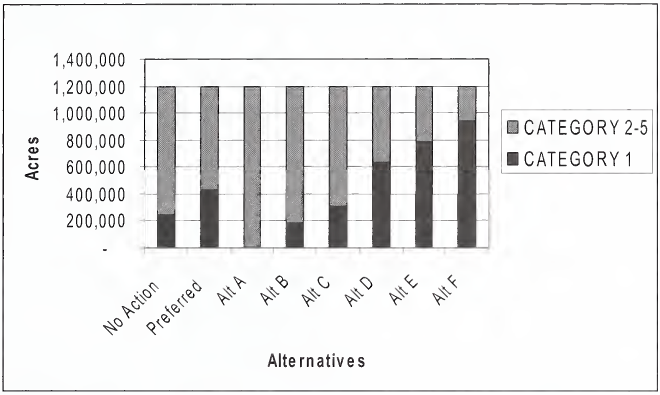
Effects on Insect and Disease Pests from Threatened, Endangered and Sensitive Species Management
The concern for protection of threatened, endangered, and sensitive species plant and animal species will result in specific requirements being incorporated into any activity planned to reduce forest pests where one of the TES species may be present. Concern about these species may result in limited or no action taken to mitigate pests in affected areas. Habitat requirements of some forest-inhabiting sensitive species, such as the goshawk, generally require reductions in human presence and related activities. An active nest could postpone treatment in an area during the nesting season.

In general, those alternatives that have reduced levels of management activity, that may be more beneficial for mature forest associates, also tend to favor stands that are most susceptible to bark beetle infestations, in particular.

Effects on Insect and Disease Pests from Wilderness, Wild and Scenic Rivers, and Research Natural Areas Management
Category 1 management area prescriptions are land allocations where natural disturbance processes are emphasized. Susceptibility to insect and disease pests would be expected to increase over time in Category 1 areas as forested stands age. Figure 3-18 shows the acres of forested lands in Category 1 management prescriptions by alternative versus Categories 2 - 5 combined.

Alternatives rank according to the acreage allocated in Category 1 prescriptions. Alternatives which would be expected to have the highest level of susceptibility to insect and disease pests over time are F, E, and D, the Preferred, C, the No Action, B, and A, respectively.

Figure 3-18: Acres of forested land on the Chugach National Forest in Category 1 prescriptions by alternative.



Cumulative Effects

Insects and diseases do not recognize property lines. They travel from one ownership to another, generally at a very slow pace. During periods of epidemic levels, such as the 1.3 million acre spruce beetle outbreak, dramatic and rapid Forest change can occur. In the long run, alternatives that enhance a balanced mix of diverse habitats would likely better withstand pressures from various insect and disease pests and will provide greater habitat for beneficial species. Alternatives that emphasize timber production or vegetation management would reduce the average age and density of forest stands, which may reduce spruce beetle epidemics in the future as long as management activity is sustained at similar levels over time.

Alternatives that emphasize more mature and late successional landscapes would likely sustain greater bark beetle damage for a longer period of time before evolving to a more sustainable balance, especially if fire is not present as a primary force in the ecosystem. The degree to which these effects would remain over time would depend largely upon the magnitude of management activities or lack thereof.

If insect and disease outbreaks occur within Wilderness areas or other areas receiving little or no management, they may spread from these areas to areas managed for other resources and threaten the management objectives of the

other areas. Decisions to suppress the outbreaks, to initiate salvage operations where allowed, or to allow the outbreaks to continue will have to be made on a case-by-case basis. This would also affect management activities on lands adjacent to or close to Wilderness.

Figure 3-19 compares the cumulative acreage of management activity on Forestland under the fuel reduction, forest restoration, wildlife, and timber program at the end of the first decade with forestlands that would remain under the influence of natural processes. Figure 3-20 makes the same comparison, but at the end of the fifth decade. Ranking the alternatives by treated acreage, Alterative A is highest followed by B, the No Action, C, the Preferred, D, E, and F, with F being the least beneficial.

Figure 3-19: Cumulative acres of treated and untreated forestland - decade 1.

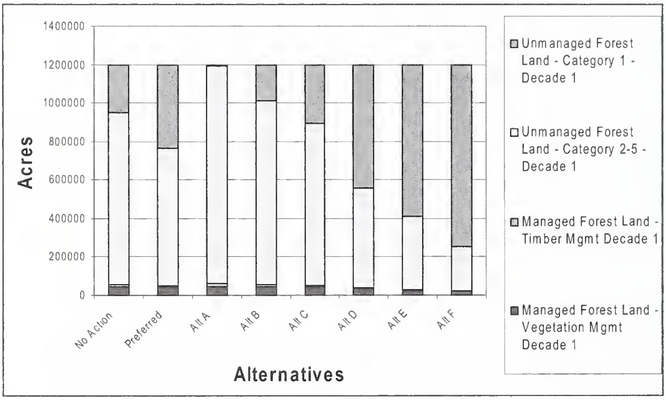
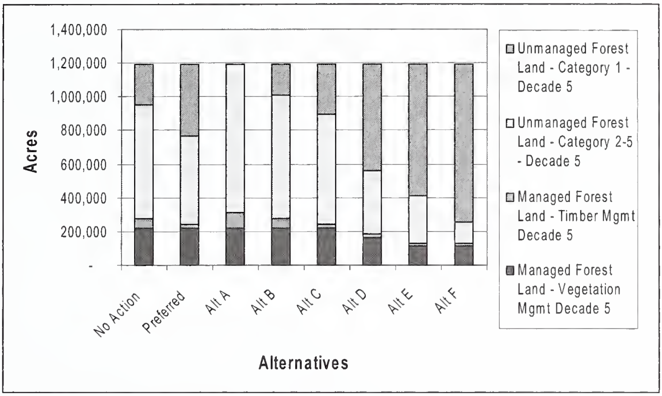


Figure 3-20: Cumulative acres of treated and untreated forestland - decade 5.



Forested Vegetation

Introduction

The forested ecosystems and associated vegetation of the Chugach National Forest are very dynamic. The processes of plant succession and associated disturbance patterns have produced the current vegetative conditions. These natural processes, both part of and necessary for ecosystem function, will continue to produce changes in the future. Therefore, the following description of current forested vegetation represents one point in time. Some of the changes are generally predictable, others less so.

Legal and Administrative Framework

- The **National Forest Management Act of 1976 (NFMA)**
- **Planning Regulations (36 CFR 219)**
- **Ecosystem Management** - In 1992, the Chief of the Forest Service issued a statement committing the Forest Service to the practice of ecosystem management, which is an ecological approach to managing national forests and grasslands for multiple uses.

Key Indicators

- Acres of vegetation treatments
- Acres of forested cover types
- Acres of forest cover type structural stage distribution

Resource Protection Measures

The Revised Forest Plan contains numerous Forestwide and management area prescription standards and guidelines concerning vegetation management. All alternatives provide for satisfactory regeneration of harvest areas, for treatment of activity related fuels, and various wildland fire management strategies needed for resource protection.

Affected Environment

Current Vegetation Composition

Since 1993, a network of 27 forest monitoring plots has been established on the Kenai Peninsula by the Chugach National Forest Ecology Program. The purpose of these plots is the quantification of overstory and undergrowth vegetation compositional changes within forests of the Kenai Peninsula portion of the Chugach National Forest, with emphasis on Lutz spruce (*Picea X lutzii*) forests affected by the spruce bark beetle. Change in canopy composition is occurring as spruce die from spruce bark beetle infestation (Table 3-32a). Understory compositional change is anticipated in response to changes in canopy closure

but these changes are not yet significant. It seems reasonable to expect undergrowth composition changes in plots 93PRM001, 93PRM009, 93PRM010, 93PRM012, and 94PRM013 in future monitoring in response to the indicated changes in overstory composition.

Table 3-32a: Changes in *Picea* X *lutzii* canopy intercept on 16 of the 27 permanent plots established on the Kenai Peninsula by the Chugach National Forest Ecology Program.

Plot ID	Spruce 1995 Intercept feet	Spruce 1997 Intercept feet	Change in Intercept feet	% Change
93PRM001	67	40	-27	-40
93PRM002	33	29	-4	-12
93PRM003	118	108	-10	-8
93PRM004	157	170	+13	+8
93PRM005	99	103	+4	+4
93PRM006	140	134	-6	-4
93PRM007	101	100	-1	-1
93PRM008	133	134	+1	+1
93PRM009	103	88	-15	-15
93PRM010	86	73	-13	-15
93PRM011	76	72	-4	-5
93PRM012	93	69	-24	-26
94PRM013	154	183	+29	+19
94PRM014	147	152	+5	+3
94PRM015	114	119	+5	+4
94PRM016	128	130	+2	+2

Vegetation on the Forest has also been classified into several cover types, including both forest and non-forest types. The descriptive names used are based on the major canopy species found in each cover type. Many species, other than those listed, also occur in each type. Cover types for the Forest, their acreages, and the percent of the total Forest are listed in Table 3-32b.

Table 3-32b: Cover type composition on the Chugach National Forest.

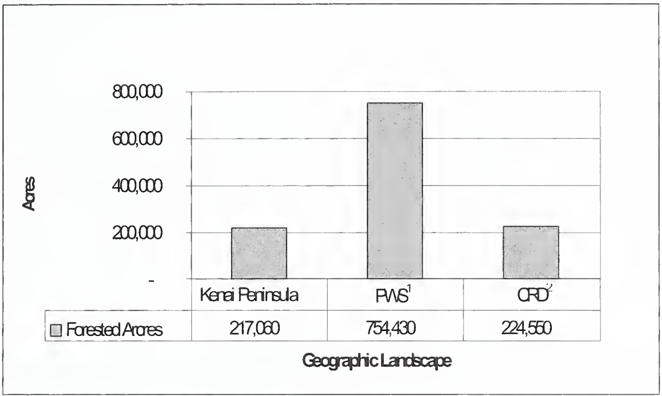
Cover Type	Acres	Percent of Forested Cover Types	Percent of Non-Forested Cover Types	Percent of All Land on CNF
Forested Cover Types				
Aspen	4,350	0.4		0.1
Birch	11,790	1.0		0.2
Cottonwood-Balsam Poplar	23,360	2.0		0.4
Mixed Hardwood-Softwood	14,430	1.2		0.3
Hemlock-Spruce	341,990	28.6		6.2
Hemlock (Western and Mountain)	594,260	49.7		10.8
Black Spruce	580	0.0		0.0
Sitka Spruce	120,530	10.1		2.2
White Spruce	35,600	3.0		0.6
Unclassified	49,150	4.1		0.9
Subtotal Forested Land	**1,196,040**	**100.0**		**21.8**
Non-Forested Cover Types				
Alder and Other Shrubs	473,366		11.0	8.6
Willow	157,870		3.7	2.9
Grasses/Other Alpine Vegetation	508,869		11.8	9.3
Rock/Snow/Ice	780,560		18.2	14.2
Other Non-forested	440,693		10.3	8.0
Water	114,035		2.7	2.1
Unclassified ANILCA/EVOS Additions	1,820,147		42.4	33.1
Subtotal Non-Forested Land and Water	**4,295,540**		**100.0**	**78.2**
Total Chugach National Forest	**5,491,580**			**100.0**

Source: Chugach National Forest GIS corporate database.

Collectively, non-forested cover types dominate the landscape of the Forest, accounting for about 78 percent of the gross area. The amount of forested land is about 22 percent (1,196,040 acres). Within the forested component, conifer forest types dominate, accounting for about 91 percent of forested lands, followed by unclassified forest about 4 percent, hardwood forest about 3 percent and mixed hardwood-conifer forest about 1 percent.

Figure 3-21 shows the distribution of forested land between the three geographic landscapes of the Forest. Prince William Sound has 63 percent of the total forested land on the Forest with the remainder almost evenly split between the Copper River Delta (19 percent) and the Kenai Peninsula (18 percent).

Figure 3-21: Forested land distribution by geographic landscape (acres), Chugach National Forest.



[1] Prince William Sound
[2] Copper River Delta
Source: Chugach National Forest GIS corporate database.

<u>Kenai Peninsula Geographic Area</u>
Needleleaf forests consist of white spruce, Sitka spruce, Lutz spruce (a hybrid of white and Sitka spruce, mapped and summarized as white spruce), mountain hemlock, and occasionally black spruce. Paper birch is the dominant deciduous forest tree and a major component of mixed hardwood-softwood forests. Cottonwood stands are common along valley bottoms and aspen stands occur sporadically on southern-facing side slopes.

Non-forested vegetation on the Kenai includes sub-alpine alder communities and rich herbaceous communities of fireweed, bluejoint reedgrass, and lady fern. Alpine vegetation often consists of dwarf shrub and low herbs including crowberry, luetkea, cassiope, and bog blueberry.

<u>Prince William Sound Geographic Area</u>
Needleleaf forests are dominated by Sitka spruce, mountain hemlock, and western hemlock. Alder and salmonberry dominate Beach fringes and avalanche chutes. Alpine and sub-alpine habitats are less extensive than on the Kenai, with a larger proportion of ice, snow, and rock. Non-forested shrub and herbaceous vegetation commonly includes salmonberry, crowberry, cotton grass, luetkea, bluejoint reedgrass, sedges, and sphagnum mosses.

<u>Copper River Delta Geographic Area</u>
Needleleaf forests include western hemlock and Sitka spruce. Deciduous forests of cottonwoods are common on alluvial surfaces. Forests often occur as narrow stringers between extensive open wetlands. Dominant wetland herbaceous vegetation includes horsetail, buckbean, sedges, bluejoint reedgrass, and

sphagnum mosses. Wetland shrub communities include sweetgale, alder, and willow species. Due to the uplift from the 1964 Alaska Earthquake, the vegetation on formerly inundated lands of the outer Copper River Delta are undergoing rapid successional change, with shrub and tree species becoming more dominant.

Current Forest Structure

Forest structural stages (the developmental stages of tree stands in terms of tree size, age and canopy closure) are used to describe wildlife habitats as well as visual resources. These structural stages are displayed in Table 3-33. Actual age information for the forested stands on the Forest is limited. However, structural stage information can be used as a reasonable substitute for age.

Table 3-33: Forested stand structural stages.

Structural Stage	Description	Dbh Range (Inches)	Age Range (Years)	Canopy Closure Range (Percent)
0	Grass/Forb	Not Applicable	0 - 5	0 - 100
1	Seedling/sapling	0 - 4.9 inches dbh	0 - 5 seedling; 6 - 20 sapling	10 - 100
2	Poletimber	5.0 - 8.9 inches dbh	21 - 80	10 - 100
3	Young Mature (Young-growth Sawtimber)	9.0 - 20.9 inches dbh	81 - 120	10 - 100
4	Old Mature (Old Growth Sawtimber or Late Successional)	21.0+ inches dbh	120+	10 - 100

Structural stage data has not been collected on about 50 percent of the forested land on the Forest and is displayed in Figure 3-22 as “No Data.” This acreage represents unproductive forest in ANILCA additions and/or at higher elevations and is assumed to be in structural stage 2, 3, or 4. Besides the “no data,” structural stage 4 dominates with 34 percent of the total forested acreage, followed by stage 2 (11 percent), stage 3 (4 percent), stage 0 (2 percent) and stage 1 (1 percent).

Figure 3-23 displays the structural diversity within forest types by showing the percentage of available timberlands by forest type and structural stage on the Forest. With the exception of cottonwood forest type, which is almost evenly distributed across all structural stages, the other forest types are predominately in structural stages 3 or 4.

Figure 3-24 displays the acreage distribution of structural stages for all available timberlands on the Forest. Structural stage 4 (late successional, old mature sawtimber) dominates with 66 percent. Structural stages 3 and 4 combined account for 92 percent of the available timberlands while the stages 0, 1 and 2 make up 8 percent.

Figure 3-22: Structural stages of forested lands on the Chugach National Forest.

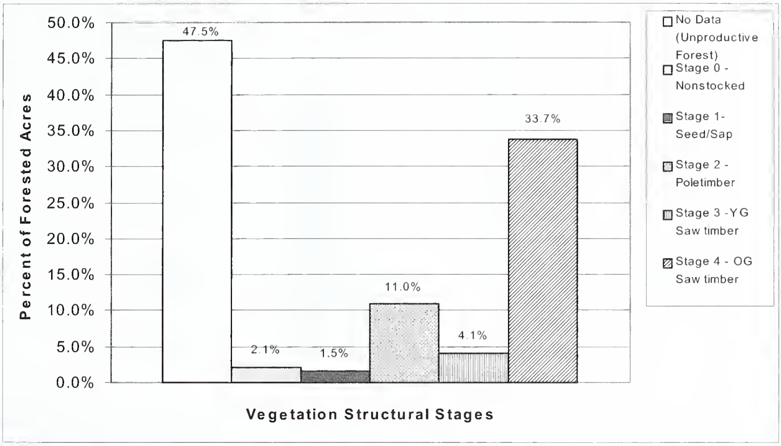
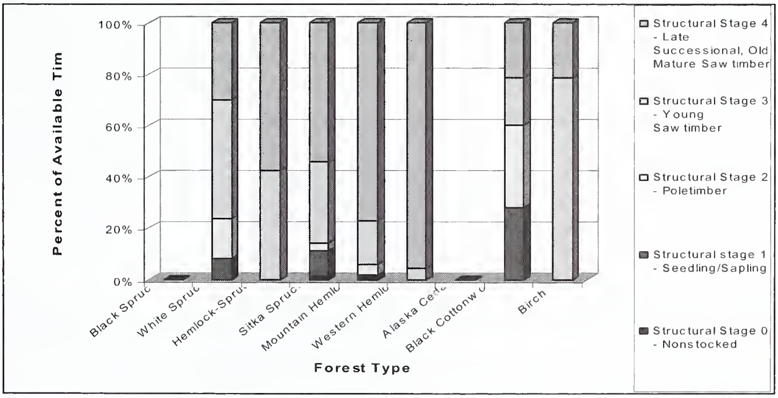
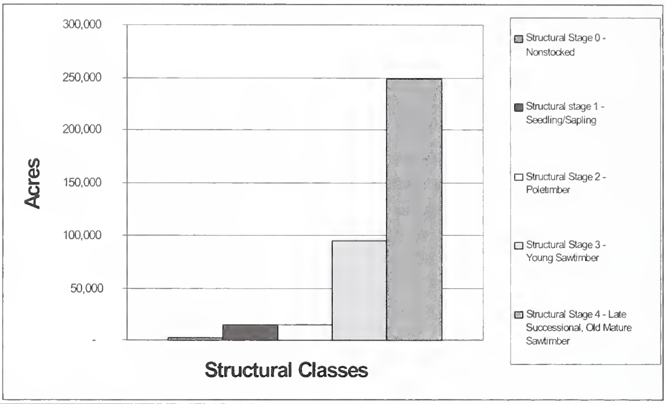


Figure 3-23: Percent of available timberlands by forest type and structural stage on the Chugach National Forest.



Source: Forest Resources of Prince William Sound and Afognak Island, Alaska: Their Character and Ownership, 1978, PNW RB 163 and Timberland Resources of the Kenai Peninsula, Alaska, 1987,PNW RB 180.

Figure 3-24: Acres by structural stage for available timberlands on the Chugach National Forest.



Source: Forest Resources of Prince William Sound and Afognak Island, Alaska: Their Character and Ownership, 1978, PNW RB 163 and Timberland Resources of the Kenai Peninsula, Alaska, 1987,PNW RB 180.

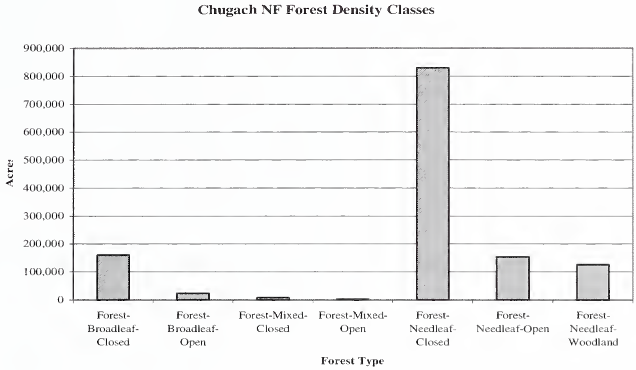
Both vertical and horizontal structural diversity are important to wildlife. Vertical structural diversity increases when there are a variety of layers within a stand. Horizontal structure refers to the spatial arrangement of structurally different stands on the landscape. Horizontal diversity increases when there are a variety of structural stages across the landscape. Conversely, structural diversity decreases when there are few layers within a stand or when landscapes dominated by a particular structural condition have limited horizontal diversity.

Horizontal structural diversity has also been assessed with the Forest satellite land cover type classification. Closed, open, and woodland needleleaf, broadleaf and mixed forest types are summarized in Table 3-34 and Figure 3-25. The forested lands on the Forest are dominated by closed needleleaf forest (almost 64 percent) and closed broadleaf forest (over 12 percent).

Table 3-34: Forest land cover classes of the Chugach National Forest.

Land Cover Class	Percent
Forest-Broadleaf-Closed	12.28
Forest-Broadleaf-Open	1.87
Forest-Mixed-Closed	0.58
Forest-Mixed-Open	0.24
Forest-Needleleaf-Closed	63.59
Forest-Needleleaf-Open	11.79
Forest-Needleleaf-Woodland	9.65
Total	**100.00**

Figure 3-25: Forest density classes on the Chugach National Forest.

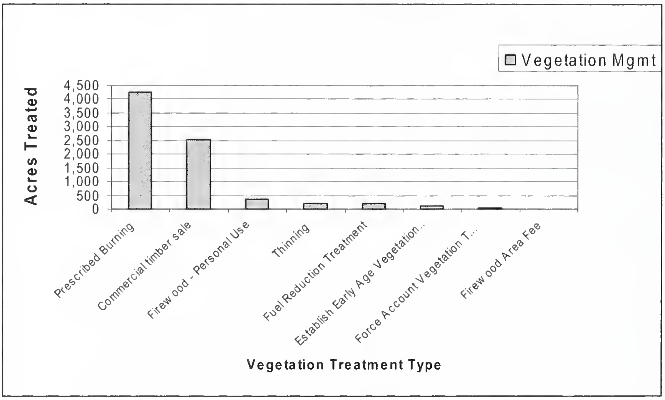


Source: Chugach National Forest GIS corporate database.

Current Management

Since 1974, human disturbance in the form of vegetation management on the Forest has averaged 311 acres per year and has been limited to the Kenai Peninsula in response to the spruce bark beetle epidemic and to improve wildlife habitat through the use of prescribed fire. Figure 3-26 shows the acreage treated by treatment type. Almost 55 percent of all vegetation treatments have been prescribed burns for wildlife habitat. Commercial timber sales have accounted for less than 33 percent of the total vegetation treatments. The total acreage treated (7,785 acres) amounts to 3.6 percent of the total forest on the Kenai Peninsula or 0.7 percent of the total forest on the Chugach.

Figure 3-26: Vegetation management on the Chugach National Forest by activity, 1974-1999.



Environmental Consequences

General Effects

All alternatives provide a variety of vegetation management activities that improve forest health conditions. None of the alternatives would result in significant changes in the existing situation. In all alternatives, the majority of the Forest would continue to be influenced primarily by natural processes.

Natural disturbance events (fire, floods, windstorms, landslides, avalanches, insect and disease outbreaks, etc.) would continue to operate regardless of the alternative. Implementation of any given alternative would influence vegetation by the degree to which natural disturbance events are allowed to operate and according to the levels of various human-caused disturbance events, such as fuel reduction, timber harvest or wildlife habitat improvement.

Cover Types - Forestwide, during the planning period (the next 10-15 years), the majority of forested cover types on the Forest are expected to move through natural succession and become older in all alternatives. In the absence of major disturbance events during the next 50 years, some paper birch and aspen stands on the Kenai Peninsula would slowly be replaced by shade-tolerant hemlock-spruce. As the spruce bark beetle infestation on the Kenai Peninsula continues to take its toll on the remaining mature spruce trees in pure and mixed stands, hemlock, paper birch, young spruce trees, and herbaceous and shrubby vegetation may become more dominant in these stands. The hemlock type on the Forest is expected to maintain itself. In both Prince William Sound and the Copper River Delta, the Sitka spruce and mixed hemlock-spruce types are expected to maintain themselves. Barring large-scale disturbances, succession would continue to move vegetation toward a climax condition. In general, this means that the acreage in late successional species such as hemlock and spruce would increase at the expense of early successional species such as aspen, birch, and/or cottonwood. Other plant communities would also move toward their climax condition. Together, both natural and human-caused disturbance processes would influence plant succession on the Forest. The degree to which succession is influenced depends in large part on the magnitude and type of disturbance.

Structural Stages - As the forest continues to grow, individual forest plant communities would gradually move into more mature stages. Acreage in structural stage 4 would increase as the acreage in structural stages 1, 2 and 3 decreases. This maturation would be accompanied by an increase in crown cover. As a result, the acreage in crown closure classes would also increase in both structural stages 3 and 4. Consequently, total acreage in late successional forest, structural stage 4, would increase with time. Once again, disturbance processes would play a major role in determining future forest structure. When major disturbance events occur, the disturbed area would move into one of the other structural stages. Many of these areas may go to a structural stage 0 or 1.

Direct and Indirect Effects

Effects from Vegetation Management

Vegetation management can alter both cover type composition and/or structural stage by removing, leaving, or regenerating trees during/after prescribed burning, hazard tree removal, stand thinning, timber harvest, site preparation (mechanical or prescribed burning), and reforestation treatments for fuel reduction, wildlife habitat improvement, insect and disease suppression, forest restoration, recreation or visual resource objectives.

The amount of vegetation management proposed during the planning period varies by alternatives and is focused almost exclusively on the Kenai Peninsula under the Forest's "Kenai Peninsula Spruce Bark Beetle Management Strategies & Five-Year Action Schedule" for the spruce bark beetle impacted Kenai Peninsula (USDA Forest Service 1999a). Table 3-35 shows the proposed vegetation management treatment types by alternative for first decade.

Treatments are categorized as being either even-aged or uneven aged silvicultural treatments.

Cover Types – Changes in cover type composition are most likely to occur in the prescribed fire treatments (even-aged) that could decrease the acreage of spruce, mixed hardwood-spruce or mixed hemlock-spruce cover types while increasing the acreage in the early successional cover types of paper birch or aspen. Mechanical treatment (even-aged) of birch and aspen cover types for wildlife objectives is not expected to result in cover type changes. Uneven-aged treatments (hazard tree removal and stand thinning for wildlife) along with even-aged reforestation treatments are not expected to result in cover type changes.

Table 3-35: Acres of vegetation treatments by alternative (M[1] acres) - decade 1.

Vegetation Management Treatments	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Prescribed Fire – Fuel Reduction[2]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Prescribed Fire - Wildlife								
Early Successional Species	21.50	21.50	21.50	21.50	21.50	14.90	8.70	8.80
Sheep/Goat	0.63	0.63	0.63	0.63	0.63	0.44	0.26	0.26
Brown Bear	0.30	0.31	0.30	0.30	0.30	0.21	0.12	0.12
Spruce Dependent Species	0.05	0.05	0.05	0.05	0.05	0.03	0.02	0.02
Total Wildlife Prescribed Fire	**22.48**	**22.49**	**22.48**	**22.48**	**22.48**	**15.58**	**9.10**	**9.20**
Total ALL Prescribed Fire	**26.48**	**26.49**	**26.48**	**26.48**	**26.48**	**19.58**	**13.10**	**13.20**
Mechanical (Non-TES Species)	13.55	13.55	13.55	13.55	13.55	9.75	5.69	5.78
Mechanical (TES Species)	2.50	2.50	2.50	2.50	2.50	1.52	0.89	0.90
Total Mechanical - Wildlife	**16.05**	**16.05**	**16.05**	**16.05**	**16.05**	**11.27**	**6.57**	**6.68**
Hazard Tree Removal	4.18	4.18	4.18	4.18	4.01	3.48	3.18	3.18
Stand Thinning/Pruning/ Pest Mgmt - Wildlife	0.54	0.38	0.54	0.54	0.54	0.37	0.21	0.23
Total Stand Improvement	**4.72**	**4.56**	**4.72**	**4.72**	**4.55**	**3.85**	**3.39**	**3.41**
Reforestation								
Reforestation – Forest Restoration	7.32	7.32	7.32	7.32	7.32	5.84	5.00	4.73
Reforestation – Fish and Wildlife	18.02	17.57	18.02	18.02	18.02	17.77	17.54	4.46
Total Reforestation	**25.34**	**24.89**	**25.34**	**25.34**	**25.34**	**23.61**	**22.54**	**9.19**
Grand Total All Treatments	**72.59**	**71.99**	**72.58**	**72.59**	**72.42**	**58.23**	**45.56**	**32.43**

[1] thousands of acres
[2] Based on "Spruce Bark Beetle Management Strategies & Five-Year Action Schedule, (USDA Forest Service 1999a).

Alternatives with the greatest potential to change cover types are those with the highest amounts of prescribed fire. The No Action Alternative, the Preferred Alternative, and Alternatives A, B, and C all have equal amounts of prescribed fire and therefore the greatest potential for conversion of cover types on the treated acreage. Alternatives with the least potential for cover type conversion in decreasing order are D, F and E.

Structural Stages – Changes in structural stages are associated with treatments under even-aged management. Uneven-aged management that removes hazard trees or thins stands for wildlife objectives are not expected to alter the structural stages of forested stands. The No Action Alternative, the Preferred Alternative, and Alternatives A, B and C have equal amounts of even-aged treatments and have the highest potential for changing structure from a stage 3 or 4, to a stage 0 or 1 by the respective acreage treated. Having the least potential for structural changes in decreasing order are D, F and E.

Effects from Fire Management

Fires are almost nonexistent in two of the three geographic landscapes, Prince William Sound and the Copper River Delta, due to wet climatic conditions. Consequently, no effects from fire management are predicted for these two areas.

On the Kenai Peninsula, fires, both wildland and prescribed, can and have altered forest composition by increasing abundance of pioneer species such as paper birch and aspen while reducing later successional species such as hemlock and spruce. Structural post-fire changes depend on the existing conditions and the type of fire. Cool ground fires would primarily reduce spruce and hemlock seedlings, saplings and ground litter. Very hot, stand-replacing fires can reset stands back to structural stage 0 (grass/forb), completely changing stand structure. Most fires burn in a mosaic pattern, ranging from untouched mature to the grass/forb stage. Planned fires can influence forest processes by reducing the hazard and intensity of subsequent fires.

As displayed in Table 3-39, the use of prescribed fire for fuel reduction objectives would treat 400 acres annually or 4,000 in the first decade. The amount is the same under all alternatives and therefore the effects would be the same under all alternatives.

Cover Types – With 4,000 acres of prescribed fire in the first decade, some cover type changes from spruce, mixed hemlock-spruce, or mixed hardwood-spruce cover types to birch, aspen, cottonwood, mixed hardwood, grass/forb or shrub cover types are expected. The amount of change is difficult to predict due to the number of variables involved. The maximum scenario under all alternatives would be a net reduction of 4,000 acres of conifer cover types, with a corresponding increase of 4,000 acres in hardwood cover types and/or grass/forb, or shrub cover types at the end of the first decade.

Structural Stages – Prescribed fire for fuels reduction in forested stands would result in moving some stands from late successional (stage 4) to early successional stages (stage 0 or 1). At the end of the first decade, assuming all

400 acres were completely burned each year, 2,000 acres of structural stage 4 forest would have moved to stage 1 (acres burned in the first five year period) and 2,000 acres would have moved to stage 0 (acres burned in the second five year period) for a net decrease of 4,000 acres in structural stage 4 forest.

Effects from Recreation

Recreation is expected to increase under all alternatives. Recreation in developed sites with fire grates, can lead to a reduction in fuelwood sources, (snags and down woody material). This can extend outside the confines of the site, but is usually small in scale.

Repetitive concentrations of people can lead to soil compaction, physical injuries to trees, trampling of shrubs, grass, and forbs, and result in increased susceptibility of these plants to mortality. In riparian zones, loss of vegetative cover can destabilize stream banks. Winter recreation, including snowmobiling and skiing, compact snow and slow melting in the spring. This in turn can have an effect on vegetation under or near the areas of compaction. Snowmobilers and, to a lesser degree, skiers can also cause physical damage to trees not covered by the snow pack. In general, the effects from recreation described above occur in isolated areas of heavy use and are not significant at the Forestwide level.

The main effects on forest cover types and structural stages from recreation would result from tree removal during construction or expansion of facilities such as campgrounds, trails, trailheads, interpretive sites, and recreation roads. Depending on the activity, effects on cover type and structure range from no effect to conversion of forest cover types to nonforest cover types (see effects from roads and trails discussed under access management in this section). Overall, no significant changes to Forestwide cover types or structural stages are expected in any alternative.

Effects from Wildlife Management

As displayed in Table 3-39, the majority of planned activities to benefit wildlife species would be prescribed fire to create or improve habitat for species that benefit from early successional cover types. The effects from wildlife management vary by alternative according to the proposed treatments for wildlife habitat improvement in Table 3-39.

<u>Cover Types</u> – Out of the total vegetation treatments for wildlife, only prescribed fire treatments for early successional habitat enhancement is expected to result in a change in cover types from late successional cover types to early successional types by the respective acreage treated. Prescribed fire for sheep/goat, brown bear and spruce-dependent species are not expected to change cover types. Burns for sheep/goat would be mostly in timberline stands and/or alpine cover types while burns for brown bear and spruce-dependent species would be reforested back to spruce. The No Action Alternative, the Preferred Alternative, and Alternatives A, B, and C have equal amounts of early successional prescribed fire and would have the greatest amount of change while the alternatives with the least amount in decreasing order are D, F and E.

Structural Stages - Changes in structural stages are associated with treatments under even-aged management. Uneven-aged management that removes or thins stands for wildlife objectives are not expected to alter the structural stages of forested stands. The No Action Alternative, the Preferred Alternative, and Alternatives A, B, and C have equal amounts of even-aged treatments and have the highest potential for changing structure from a stage 3 or 4 to a stage 0 or 1 by the respective acreage treated. Having the least potential for structural changes in decreasing order are D, F, and E.

Effects on Threatened, Endangered, Sensitive Species (TES) Management
In general, habitat requirements in and around each known or discovered TES location will be protected, restored, or enhanced. As displayed in Table 3-39, mechanical treatment to benefit TES wildlife species varies by alternative ranging from a low of 890 acres in Alternative E to a high of 2,500 acres in the No Action Alternative, the Preferred Alternative, and Alternatives A, B and C during the first decade.

Cover Types – Mechanical treatments for TES wildlife species are not expected to result in any significant cover type changes under any of the alternatives.

Structural Stages – Some change in structural stage on a portion of the treated acreage is expected, but the exact amount would depend on the site-specific conditions of the TES habitat. Overall, structural change resulting from mechanical treatments is expected to be insignificant under all alternatives.

Effects from Mineral Exploration and Development
Development of access roads and ground-disturbing mineral exploration may affect some forest stands. Because the potential for intensive development of locatable or leasable minerals is considered to be low in all alternatives, no significant changes to Forestwide cover types or structural stages are expected.

Effects from Heritage Resource Management
Vegetation management can be precluded due to the significance of a site. In these cases, trees on the site would mature, reproduce and eventually die. Excavations can reduce vegetative cover, especially in the understory. No significant changes to Forestwide cover types or structural stages are expected in any alternative.

Effects from Access Management
Road construction can lead to changes in plant species composition due to modifications in site conditions. Vegetation along the road corridors may be stressed due to changes in site conditions that contribute to increases of certain insect and disease pests. However, roads provide access for conducting forest pest management activities to reduce or prevent damage caused by insect and disease pests.

Roads and trails can function as firebreaks, reducing the fire hazard. Suppression capabilities are improved in areas with road access. Fire risks increase in relation to the number of people using an area. Therefore, available road densities enhance fire suppression and while increasing fire risk.

Road obliteration would increase vegetative cover. Left alone these areas would eventually revert back to the surrounding vegetation.

The majority of impacts to forest vegetation from travel management would result from vegetation alterations during the construction and reconstruction of roads and trails to meet access management objectives. The estimated acreage that would be converted to roads and trails after the first decade is displayed in Table 3-36.

Table 3-36: Acres of vegetation converted to roads and trails by alternative - decade 1.

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Roads	405	199	690	608	173	134	97	76
Trails	38	105	101	113	135	107	51	19
Total	**443**	**304**	**791**	**721**	**308**	**241**	**149**	**95**

Most of the above acreage would be located in forested stands that would be converted and maintained as non-forest roads and trails, with corresponding net reductions in both forest cover types and structural stages. Forestwide, the amount under all alternatives is insignificant.

Effects from Utility Corridors and Electronic Sites

Vegetation management within existing utility corridors is designed to keep trees from reaching suspended lines. Within forested communities, the overstory is suppressed by removing trees. This alteration in site conditions can lead to changes in species composition. Trees that regenerate within the corridor are cut before they pose a problem to the lines. While the cover type is generally not changed, structure within the corridor is primarily seedling/sapling, while adjacent areas may retain mature forest conditions. Electronic sites generally have no effect on forested communities due to their placement on mountaintops.

Fire hazards are reduced where corridors or road access to corridors or electronic sites bisect forest communities, due to the breakup of fuel continuity. The risk of fire ignitions is increased because of the potential for downed power lines and/or improved access for people. Surface disturbance from line construction, tree removal and vehicle access also increases the potential for fire ignitions.

Some forested stands would be converted and maintained as early structural stage vegetation during development. This allocation would reduce the increase of acreage of younger structural stands and sharply define edges between the utility right-of-way and adjacent areas. Due to the small acreage allocated to this use, Forestwide impacts are expected to be minor in all alternatives.

Effects from Timber Management

Table 3-37 shows the acreage treated by alternative during the first decade under the timber management program. Treatments are categorized as being either even-aged or uneven-aged silvicultural treatments. Only the No Action Alternative and Alternatives A and B have a suitable timberland base that contributes to the allowable sale quantity.

Cover Types – No significant changes to cover type acreages are anticipated under any alternative.

Structural Stages – The majority of forested acres would be managed through natural disturbance processes rather than through active silvicultural treatments. Uneven-aged silviculture in all alternatives and stand thinning in Alternative A, the No Action Alternative and Alternative B is not expected to change the structural stage of treated stands in any of these alternatives.

The greatest impact to structural stage is expected to result from even-aged silvicultural treatments in the hemlock, spruce and hemlock-spruce cover types within the suitable timberlands in Alternative A, the No Action Alternative and Alternative B. Because of the small acreage planned for active treatments, Forestwide, stands would continue to age and acreages in structural stages 3 and 4 are expected to increase in all alternatives. Structural stages 0, 1 and 2 would continue to make up relatively low percentages for all cover types across the forest at the end of the first decade.

Table 3-37: Acres of timber harvest treatments by alternative (M[1] acres) - decade 1.

Timber Harvest	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Timber Harvest Even-Aged								
Even-Aged Management (ASQ)	2.96	0	6.17	2.34	0	0	0	0
Even-Aged Management - Forest Restoration	0	0	0	0	0	0	0	0
Even-Aged Management - Free and Personal Use	0	0	0	0	0	0	0	0
Total Even-Aged Management	**2.96**	**0**	**6.17**	**2.34**	**0**	**0**	**0**	**0**
Timber Harvest Uneven-Aged								
Uneven-Aged Management (ASQ)	0.74	0	1.54	0.58	0	0	0	0
Uneven-Aged Management - Forest Restoration	2.77	2.77	2.77	2.77	2.57	2.28	1.48	1.30
Uneven-Aged Management - Free and Personal Use	3.24	0.98	4.82	4.35	1.69	1.27	1.12	1.05
Total Uneven-Aged Management	**6.75**	**3.75**	**9.13**	**7.70**	**4.26**	**3.55**	**2.60**	**2.35**
Total Timber Harvest	**9.71**	**3.75**	**15.30**	**10.04**	**4.26**	**3.55**	**2.60**	**2.35**
Site Preparation								
Mechanical	0.95	0	1.8	0.75	0	0	0	0
Prescribed Fire	2.33	0.90	3.67	2.41	1.02	0.85	0.62	0.56
Total Site Preparation	**0.58**	**0.23**	**0.92**	**0.60**	**0.26**	**0.21**	**0.16**	**0.14**
Reforestation								
Reforestation – Natural	7.28	2.81	11.48	7.53	3.20	2.66	1.95	1.76
Reforestation – Planting	5.82	2.25	9.18	6.02	2.56	2.13	1.56	1.41
Total Reforestation	**13.10**	**5.06**	**20.66**	**13.55**	**5.75**	**4.79**	**3.51**	**3.17**

[1] thousands of acres

Cumulative Effects

The cumulative effects for forest vegetation consider lands within the boundaries of the Chugach Forest. The majority of forested vegetation within the cumulative impacts assessment area occurs on the Forest. A complete set of forest cover type and structural stage data is not available for other landowners within the boundary of the Forest, and thus is not available for this cumulative effects analysis. Most non-National Forest System forested lands within the assessment area belong to three major landowners: the State of Alaska, the Kenai Peninsula Borough, and regional and village native corporations. Based on current and projected market conditions for timber, post-oil spill restoration and recovery in Prince William Sound, and social, human-related disturbance on non-National Forest System lands within the Forest boundary during the planning period is estimated to be insignificant in the context of the land base within the Forest boundary.

On National Forest System lands within the assessment area, Tables 3-38 and 3-39 show the estimated cumulative effects of human-related disturbance on forest cover types and structural stages in the first decade that may result from implementing the revision alternatives. Effects on cover types and structural stages from natural succession were not estimated for the first decade, but are assumed to be minimal in such a short time period.

Cover Types - Table 3-38 shows the estimated change in forest cover type acres by alternative that may result from the human-related disturbance activity during decade 1 under full funding implementation. The greatest overall impacts on forest cover types may result from prescribed burning for wildlife habitat improvement. The potential cumulative change in forest cover types is highest in Alternative A followed in decreasing order, by Alternative B, the No Action Alternative, Alternative C, the Preferred Alternative, and Alternatives D, F, and E.

Table 3-38: Estimated acreage change in forest cover type by alternative (M* acres) – decade 1.

Human Disturbance Activity	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Roads and Trails	0.44	0.30	0.79	0.72	0.31	0.24	0.15	0.10
Prescribed Fire - Fuel Reduction	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Prescribed Fire - Wildlife (Early Successional Habitat)	21.50	21.50	21.50	21.50	21.50	14.90	8.70	8.80
Total Acres Resulting in Change	**25.94**	**25.80**	**26.29**	**26.22**	**25.81**	**19.14**	**12.85**	**12.90**
Percent of Forest Cover Types	**2.2%**	**2.2%**	**2.2%**	**2.2%**	**2.2%**	**1.6%**	**1.1%**	**1.1%**

* Thousands of acres

Structural Stages - The majority of forested acres on the Chugach Forest would be managed through natural disturbance processes during the planning period rather than through active silvicultural treatments. Within suitable timberlands for the No Action Alternative and Alternatives A and B, 20 percent of the timber harvest would be uneven-aged silvicultural treatments, which are not expected to change the structural stage of the treated stands.

Table 3-39 shows the estimated change in forest structural stage acres by alternative that may result from the human-related disturbance activity during the first decade. The greatest overall impacts on structural stages may result from prescribed burning for wildlife habitat improvement. The potential cumulative change in forest cover types is highest in Alternative A, followed in decreasing order by No Action, B, C, Preferred, D, F, and E.

Table 3-39: Estimated acreage change in structural stage by alternative – decade 1.

Human Disturbance Activity	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Roads and Trails	0.44	0.30	0.79	0.72	0.31	0.24	0.15	0.10
Prescribed Fire - Fuel Reduction	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Prescribed Fire - Wildlife (Early Successional Habitat)	21.50	21.50	21.50	21.50	21.50	14.90	8.70	21.50
Prescribed Fire - Sheep/Goat	0.63	0.63	0.63	0.63	0.63	0.44	0.26	0.26
Prescribed Fire - Brown Bear	0.30	0.31	0.30	0.30	0.30	0.21	0.12	0.12
Prescribed Fire - Spruce Dependent Species	0.05	0.05	0.05	0.05	0.05	0.03	0.02	0.02
Mechanical Treatment Wildlife - Non-TES	13.55	13.55	13.55	13.55	13.55	9.75	5.69	5.78
Timber Harvest Even-Aged (ASQ)	2.96	0	6.17	2.34	-	-	-	-
Total Acres Resulting in Change	**43.43**	**40.34**	**46.99**	**43.09**	**40.34**	**29.57**	**18.94**	**19.08**
Percent of Forest Cover Types	**3.6%**	**3.4%**	**3.9%**	**3.6%**	**3.4%**	**2.5%**	**1.6%**	**1.6%**

Plants

Introduction

The complex geology, varied climate, and periodic disturbances of the habitats of Southcentral Alaska and the Chugach National Forest have resulted in a diverse flora. This flora ranges from the Gulf of Alaska shorelines and wetlands of the temperate rain forest to the ice-clad Chugach and St. Elias Mountains. Some of these mountains are more than 10,000 feet high. Most plant species on the Chugach National Forest are widely distributed and common. However, some plans are of limited distribution and abundance, several of which may be locally or globally rare.

Legal and Administrative Framework

- The **National Forest Management Act of 1976 (NFMA)** states that the forest plan must "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area."
- **Ecosystem Management** - In 1992, the Chief of the Forest Service issued a statement committing the Forest Service to the practice of ecosystem management, which is an ecological approach to managing national forest and grasslands for multiple purposes.
- The **Endangered Species Act of 1973** governs the protection of listed species and the ecosystems upon which they depend.
- The **Forest Service Manual (2672)** requires the Regional Forester to identify sensitive species occurring within the region.
- The **Forest Service Manual (2672.4)** requires that a biological evaluation (BE) be prepared for all Forest Service activities to address impacts to Forest Service sensitive species.
- **36 CFR 219.27 (g)** states that management prescriptions, when appropriate and to the extent practicable, shall preserve and enhance the diversity of plant and animal communities.

Key Indicators

- Distribution of potential sensitive plant habitat by prescription category.

Resource Protection Measures

Federal regulations require that viable and well-distributed populations of all native (and desirable non-native) species be maintained across the national forest. All management activities on national forest lands will be evaluated in order to assure the protection of all rare plant species and their habitats. Rare plant inventory and monitoring will document the presence or absence of rare

plants, find plants new to the Chugach National Forest and more clearly define their habitat and distribution.

Affected Environment

Sensitive Plants

All the vascular plants known or suspected to occur on the Chugach National Forest were reviewed to develop a list of plants to discuss in this section. This subset of the Alaskan flora was further filtered to select a set of plants with potential conservation concerns.

This list of plants with potential conservation concerns includes all plants listed on the Alaska Region sensitive species list that are known or are suspected to occur in the Chugach National Forest. The Regional Forester has designated as sensitive those plants that could trend toward listing under the Endangered Species Act.

Also included are many plants designated by the Alaska Natural Heritage Program as G1-G3, S1-S2 known from or suspected to occur in the Chugach National Forest. Definitions of the rankings are shown following Table 3-40.

Other plants with potential viability concerns within the Chugach National Forest are included. Some of these plants could be common elsewhere, however the edge of their range is known to be or suspected to be in the Chugach Forest Area, or disjunct populations of the plants are known from the Chugach National Forest. The National Forest Management Act addresses concerns about population viability through the requirement that national forests maintain viable populations of species throughout their range.

Since so little is known about some of these plants, habitat information is limited to the data taken from the labels of herbarium specimens. In many instances this habitat information is very general. During the past several years, plant surveys have filled gaps in habitat and distribution information and provided information to botanists who are evaluating the taxonomy of these plants. Consequently, some of the plants previously considered to be rare have been found to be more common than previously thought, and the taxonomic status of others has been changed. Future revisions of the Alaska Region sensitive species list will reflect these changes in distributional and taxonomic information.

The body of this section is a table (Table 3-40) displaying general information about the Chugach National Forest's plants with potential conservation concerns. Information includes: scientific name; Alaska Natural Heritage ranking; and a column with an "S" or "C." Alaska Region sensitive plants are indicated with an "S," and plants being analyzed on account of viability concerns are indicated with a "C." Also shown are rangewide distributions, Chugach National Forest distribution and habitat. In addition, for each plant, there are ecological data that can be tied to one or more bioenvironmental classes, which were developed by

Rob DeVelice (Forest Ecologist); these classes are in the columns labeled Bioclim, Covtype and Landtype. Using these classes, inferences can be made to estimate where habitat for each plant might occur on the Forest.

Table 3-40: Vascular plants with potential viability concerns known or suspected to occur on the Chugach National Forest.

PLANT NAME	G RANK	S RANK	S/C	RANGEWIDE DISTRIBUTION	CHUGACH NF DISTRIBUTION	HABITAT	BIO CLIM	COV TYPE	LAND TYPE
Adiantum aleuticum	G5	S3S4	C	Prince William Sound disj S along Cordillera, to CA-AZ, scattered in E North America.	NW edge of range in insular PWS, Cordova area. Chugach populations disj from populations to east.	Moist forested ravines, wet cliffs, rock faces, talus slopes, alpine, and subalpine meadows.	1,2,3, 4,5,6, 7,8	1,2,3, 4,5	3,4,5
Agrostis thurberiana	G5	S2	C	Unimak area, disj E across south coastal AK to Chugach, disj SE to Cordillera.	NW edge of the range near Chugach. Disj. population on Kenai Peninsula.	Alpine meadows, bogs, stream margins, lake margins.	2,3,6	1,2,5	2,3
Anemone multifida var. *saxicola*	G5T4 T5	S3S4	C	Chugach area, SE to CO.	West edge of range on Kenai.	Rocky slopes, meadows, well drained soil, gravelly areas.	3,4,5, 6	4,5	2,3
Aphragmus eschscholtzianus	G3	S3	S	Aleutians E across southern AK through southwest Yukon. Regional endemic.	Kenai Peninsula, suspected to occur in mountainous areas throughout the Chugach.	Moist mossy areas, solifluction slopes, near rivulets in alpine seeps, heaths and scree slopes in the subalpine and alpine.	5,6	5	2
Arnica diversifolia	G5	S1	C	Kenai Peninsula, SE along Cordillera, S to CA.	SW edge of range on Kenai Peninsula.	Rocky gravelly areas, open areas, grassy meadows, mountains, mixed herbaceous meadows.	6	5	2
Arnica lessingii ssp. *norbergii*	G5T2 Q	S2	S	Kenai Peninsula, disj E through N southeastern AK. Regional endemic.	Several populations in the Portage area. Unakwik Inlet. Evans I., Cordova area.	From sea level to subalpine in well drained meadows, shrublands, dry meadows, forest openings and open forest.	1,3,4, 6	1,2, 3,4,	2,3,4,
Artemisia tilesii var. *unalaschcensis*	G5T3	S3	C	Endemic to southwest AK, disj on Seward Peninsula.	E edge of the range in PWS.	Well-drained areas, sandy soil, alpine, lowlands.	1,2,3, 4,5,6, 7,8	3,4,5	2,3,4, 5
Botrychium ascendens	G3?	S1	C	Widely disj in W NA.	Suspected to occur on Chugach.	Beach meadows sandy areas. Mesic to dry meadows in the alpine.	3,4,6, 7,8	2,4,5, 6	2,3,4, 5
Botrychium virginianum	G5T5	S1S2	C	Across NA, South America, Eurasia.	NW edge of the range in PWS.	Shrubby grassy areas, thickets, upper beach meadows.	1,2,3, 4	1,2,3, 4	4,5
Botrychium new 2x	G1	S1	C	Yakutat area, suspected to the NW.	Suspected to occur on Chugach.	Beach meadows sandy areas, open turfy or gravelly slopes, shores or meadows.	1,2,3, 4,8	3,4,5, 6	4,5

Table 3-40: Vascular plants with potential viability concerns known or suspected to occur on the Chugach National Forest.

PLANT NAME	G RANK	S RANK	S/C	RANGEWIDE DISTRIBUTION	CHUGACH NF DISTRIBUTION	HABITAT	BIO CLIM	COV TYPE	LAND TYPE
Botrychium new 4x	G1	S1	C	Yakutat area, suspected to the NW.	Suspected to occur on Chugach.	Beach meadows sandy areas, open turfy or gravelly slopes, shores or meadows.	1,2,3, 4,8	3,4,5, 6	4,5
Carex athrostachya	G5	S1S2	C	Southcentral and coastal AK, S to CA, UT, CO.	Disj. populations near Chugach.	Wet meadows, lowlands to moderate elevations.	1,2,3, 4,6,7	3,4	3,4,5
Carex lenticularis var. *dolia*	G5T3 Q	S3	S	Aleutians E to Kodiak I., E to the Alaska-Canada Coast range, through the Rocky Mts. south to Glacier National Park.	Kenai Peninsula, insular PWS, to be expected elsewhere in the Chugach.	Wet meadows, along lakeshores and snowbeds, generally at high elevations, subalpine, alpine.	1,2,3, 4,6,7	1,2,3, 4,5	2,3,4
Carex phaeocephala	G4G5	S1	C	Neacola Mts., W of Cook Inlet, along coast, SW to the Yukon, S along Cordillera.	At NW edge of range. Kenai Peninsula.	Wet meadows, rocky alpine slopes.	2,4,5, 6,7	3,4,5	2,3
Carex preslii	G4	S1	C	Kenai Peninsula, E and S along coast to CA and MT.	W edge of range on Kenai Peninsula.	Meadows.	6	1	4
Carex ramenskii	G4Q	S4	C	E Asia E to arctic, W and Southcentral AK.	E edge of range at Copper River Delta.	Coastal salt marsh, brackish water, beaches at high tide.	1,3	1,4,6	4,5,6
Carex stipitata	G5	S1	C	Japan disj. to southern AK, S to CA, and east across NA.	populations on Kenai Peninsula from Asia and Southeast Alaska.	Swamps and meadows, pond edges, wet low ground.	1,3,4	1,2,3, 4	3,4,5
Castilleja parviflora	G4	S2S4	C	Coastal, Kenai S to Oregon. NWC endemic.	W edge of the range in Chugach.	Alpine and subalpine meadows.	2,4,5, 6	3,4,5	2,3
Coptis aspleniifolia	G4G5	S3S4	C	Coastal, PWS to Washington. NWC endemic.	NW edge of range in eastern PWS.	Bog edges, mixed conifer forests, open forests.	1,2,3, 4	1,2,3, 4	3,3,5
Crataegus douglasii var. *douglasii*	G5T4	S1S2	C	PWS disj. to Southeast AK, disj. to NW, disj. to Great Lakes.	W edge of the range in PWS, and disj. population.	Forest edge.	1,3,4	1,2,3, 4	3,4,5
Dactylorhiza aristata	G4	S4	C	China east to Japan, Kamchatka to Southcentral AK.	E edge of range in insular and coastal PWS.	Meadows, mountain slopes, dry rocky heath.	1,3,4	1,2,3	3,4,5
Delphinium brachycentrum	G4G5	S4	C	E Asia, east to northern AK to northern Yukon, Alaska Range with disj. populations south.	S edge of the range in Chugach.	Well-drained tundra slopes.	4,6	3,4,5	2,3
Dianthus repens	G5	S4	C	N Asia E to northwestern AK. Disj. population on Kenai Peninsula.	S and E edge of the range on Kenai Peninsula, and disj. from northwest AK.	Sandy, gravelly, and rocky places, talus slopes, herbaceous meadows.	6	5	2,3

Table 3-40: Vascular plants with potential viability concerns known or suspected to occur on the Chugach National Forest.

PLANT NAME	G RANK	S RANK	S/C	RANGEWIDE DISTRIBUTION	CHUGACH NF DISTRIBUTION	HABITAT	BIO CLIM	COV TYPE	LAND TYPE
Douglasia alaskana	G2G3	S2S3	C	Endemic to S AK & SW YT, Atlin L. BC.	S coastal range edge on Kenai Peninsula.: Seward, and Crescent L.	Rocky or sandy sites in subalpine and alpine.	4,5,6	5	2
Draba kananaskis	G1Q	S1	S	Kenai Peninsula, disj. E to Alberta. Regional endemic.	W edge of range on N Kenai Peninsula.	Dry alpine, rocky ledges and slopes.	4,5,6	5	2
Eleocharis kamtschatica	G4	S2	C	East Asia, east to AK, to western BC, scattered populations to eastern North America.	Disj. population on north Kenai Peninsula and Anchorage area.	Marshes, wet meadows, bog margins. In lowlands, brackish water, upper beaches.	1,3,6	1,2,3, 4	3,4,5, 6
Eriophorum viridi-carinatum	G5	S2	C	Subarctic North America, south to NY, CO, MI, ID. Rare in YT.	NW edge of the range on Kenai Pen and Knik Arm area.	Rich bogs and meadows.	1,2,3, 4,6	1,2,3, 4	3,4,5
Geum aleppicum var. *strictum*	G5T5	S1S2	C	Across boreal North America, S to CA.	W edge of the range on Kenai near Hope, also known from Valdez area.	Meadows and thickets. Grassy clearings.	1,3,4, 6	1,2,3, 4	3,4,5
Isoetes truncata	G1G2 Q	S1	S	Known from Kodiak and Vancouver Islands, with a disj. population at Pyramid Lake, Alberta.	Suspected to occur on the Chugach.	Immersed in shallow fresh water pools or ponds.	1,2,3, 4	1,2,3, 4	3,4,5, 6
Isoetes occidentalis	G4G5	S1S2	C	W Aleutians, disj., E to base of AK Peninsula, disj. E to southeast AK, NW Cordillera & Sierras.	Suspected to occur on the Chugach.	Immersed in shallow fresh water pools or ponds.	1,2,3, 4	1,2,3, 4	3,4,5, 6
Ligusticum calderi	G3	S1	S	Kodiak I, disj. E to S southeast AK, QCI, Vancouver I.	N edge of the range at Kodiak I. Suspected to occur in the Chugach.	Alpine and subalpine meadows.	2,4,5	3,4,5	2,3
Lonicera involucrata	G4G5	S2	C	Widespread across northern NA, Pacific Coast, Cordillera.	W edge of range in PWS, and disj. population on Kayak Island.	Beach meadow ecotones, forest edges.	1,3	1,3,4	3,5
Maianthemum stellatum	G5	S2	C	Chugach Mts., Kenai, E to Yukon and boreal North America.	W edge of range on the Kenai Peninsula.	Meadows, well drained dryer areas, open forests, lakeshores.	1,3,4, 6	1,2,3	3,4,5
Oenanthe sarmentosa	G4G5	S3	C	Eastern Chugach, S to southeastern AK along coast to S CA. E to ID.	W edge of range Kayak Island.	Marshes, sluggish water, wet grassy herbaceous areas.	1,2,3, 4	1,2,3, 4	3,4,5
Osmorhiza depauperata	G5	S2S3	C	Chugach E across North America.	W edge of range on Kenai Peninsula.	Deciduous forests, on floodplains.	1,3,	1,4	3,4,5

Table 3-40: Vascular plants with potential viability concerns known or suspected to occur on the Chugach National Forest.

PLANT NAME	G RANK	S RANK	S/C	RANGEWIDE DISTRIBUTION	CHUGACH NF DISTRIBUTION	HABITAT	BIO CLIM	COV TYPE	LAND TYPE
Papaver alboroseum	G3G4	S3	S	From Kamchatka and northern Kuril Islands, disj to Cook Inlet, Kenai Peninsula disj. to N British Columbia and S Yukon.	Kenai Peninsula, Portage area, Chugach Mts.	Open areas, recently deglaciated areas, rock outcrops, sand, gravel, and on well-drained soils.	3,6	1,2,5, 6	2,3,4, 6
Papaver radicatum ssp. *alaskanum*	G5T4	S3S4	C	Aleutians, E to Bering Sea islands, Alaska Peninsula, Kodiak I. to Kenai Peninsula.	E and SE edge of range on Kenai Peninsula.	Sandy, gravelly soil, rocky tundra.	2,4,6, 7	3,4,5	2,3
Pedicularis macrodonta	G4Q	S3	C	Boreal North America.	SW edge of the range on Kenai Peninsula.	Swamps, muskegs, wet meadows.	1,2,3, 4,6,7	1,2,3, 4	3,4,5
Piperia unalascensis	G5	S2	C	Aleutians, E & S along coast, BC, WA, ID, Northern Rocky Mts., & montane CA.	Disj. populations in Chugach.	Meadows, bog edges.	1,2,3, 4	1,2,3, 4	3,4,5
Platanthera hyperborea var. *viridiflora*	G5T4 T5	S4	C	Japan-Aleutians, E to Kenai Peninsula.	E edge of range on Kenai Peninsula	Wet meadows, herbaceous back beaches, wet seepage slopes.	1,2,3, 4	1,2,3, 4	3,4,5
Poa douglasii ssp. *macrantha*	G5T5	S1	C	Coastal, PWS to California. Northwest coast endemic.	NW edge of range in near Cordova. Suspected in appropriate habitat to the W.	Sandy maritime beaches and meadows. Herbaceous meadows in sandy soil.	1,2	1,3,4, 6	3,5
Potentilla diversifolia	G5	S3S4	C	Cordilleran.	W end of range on Kenai.	Alpine meadows and slopes, solifluction soil. Open rocky slopes.	3,4,5, 6	2,3,5, 6	2,3,4
Potentilla drummondii	G5	S1	C	PWS SE to BC, ALB, WA, OR.	NW range edge in Chugach.	Alpine-subalpine meadows.	6	1	3
Primula eximia	G5	S4	C	Chukotka to Seward Peninsula, Aleutians E to Alaska Range to Canada, SE to southeastern AK.	Populations in Chugach (Cordova area, Montague I) disj. from remainder of range.	Alpine meadows. late snowbeds.	2,4,5, 6	3,4,5	2,3
Puccinellia glabra	G2Q	S2	S	Southcentral coastal Alaska.	Cook Inlet, Kenai Peninsula Endemic.	Maritime beaches, coastal wetlands.	3	1,6	3
Puccinellia triflora	G3Q	S3	C	Southcentral coastal Alaska.	Cook Inlet, Kenai Peninsula Endemic.	Maritime beaches, coastal wetlands.	3	1,6	3
Ranunculus cooleyae	G4	S4	C	SE along Coast Range to NW WA.	NW range edge on Kenai Peninsula and insular PWS. Pacific northwest endemic.	Alpine and subalpine meadows.	2,3,4, 6,7	4,5	2

Table 3-40: Vascular plants with potential viability concerns known or suspected to occur on the Chugach National Forest.

PLANT NAME	G RANK	S RANK	S/C	RANGEWIDE DISTRIBUTION	CHUGACH NF DISTRIBUTION	HABITAT	BIO CLIM	COV TYPE	LAND TYPE
Romanzoffia unalaschcensis	G3	S3	S	Eastern Aleutian Islands E to Kodiak I., through PWS, disj. to Southeast AK. Endemic to Alaska.	Insular and coastal PWS.	Cracks in rock outcrops, along stream banks, beach terraces, open rocky areas and on grassy, mossy rock cliffs along shores, "bird rocks" maritime sea cliffs.	1,3	1,3,4	3,5
Salix hookeriana	G5	S2	C	Southcentral AK along coast to CA.	W edge of the range in eastern PWS.	Stabilized sand dunes, pond edges.	1,3	1,2,3, 4	3,4,5
Salix setchelliana	G3G4	S3	C	Alaska Range, E to Coast Range in Yukon, Wrangell-St. Elias, Yakutat, S to Chugach. Regional Endemic.	SW edge of range in Chugach Mts. Suspected in Chugach Forest along large valleys and rivers.	Pioneer on moist to mesic, sandy to gravelly sites along glacial rivers and on glacial moraines in the montane zone.	1,4,6, 7	2,3,5, 6	2,3,4
Saxifraga adscendens ssp. *oregonensis*	G5T4 T5	S2S3	C	Central Alaska, E down Coast Range & Rocky Mts. to WA, ID, WY, CO.	Kenai Peninsula near W edge of range. W edge Lake Clark area.	Rocky crevices in mountains, moist gravelly rocky areas, alpine meadows.	4,5,6, 7,8	5	2,3
Scirpus rufus	G5	S1	C	Disj. populations, eastern boreal NA, N Europe, central Asia. Wide disj. in Cook Inlet.	Disj. population from Matanuska Valley in upper Cook Inlet, suspected on shores of Turnagain Arm.	Saline soil, maritime beaches.	1,3,6	1,4,6	3,5,6
Selaginella sibirica	G5	S4S5	C	Amphi-Beringian, east to western MT.	S edge of the range in Chugach. Disj. population in Chugach.	Open grassy tundra, dry alpine, dry exposed rocks and ledges, rocky slopes.	4,5,6	4,5	2,3
Senecio pauciflorus	G5	S4S5	C	NA, south along Cordillera to CA.	SW edge of the range in Chugach.	Alpine meadows, lakeshores.	4,5,6	1,2,3, 4	2,3
Stellaria alaskana	G3	S3	C	Southcentral Alaska & SW Yukon. Endemic.	Suspected to occur on Chugach.	Alpine tundra and scree slopes.	4,5,8	5	2
Stellaria ruscifolia ssp. *aleutica*	G4T2 T3	S2S3	S	Eastern Aleutians east across southern coastal Alaska to N southeast AK, Disj. population on Seward Peninsula.	Suspected to occur on Chugach.	Open gravely sites, and along creeks in the mountains. and in lowlands in same habitat.	1,3,4, 5	1,2,3, 4,5	2,3,4, 5
Taraxacum carneocoloratum	G3Q	S3	C	Endemic to Southcentral Alaska.	S edge of the range on Kenai and in Chugach Mts.	Alpine talus and scree slopes.	4,5,6, 7	3,5	2,3
Thlaspi arcticum	G3	S3	C	NE Asia, northern Alaska, S to central & Southeast AK. S Yukon, Victoria Island.	S edge of range in Chugach and Kenai Mts.	Alpine, gravels, talus, rock outcrops.	4,5,6	5	2,3

Table 3-40: Vascular plants with potential viability concerns known or suspected to occur on the Chugach National Forest.

PLANT NAME	G RANK	S RANK	S/C	RANGEWIDE DISTRIBUTION	CHUGACH NF DISTRIBUTION	HABITAT	BIO CLIM	COV TYPE	LAND TYPE
Veronica wormskjoldii var. *stelleri*	G4G5 Q	S4	C	Kamchatka, Kurils, disj., Japan, Aleutians, disj. to Kenai, disj. to Juneau area.	E edge of main range on Kenai Peninsula.	Meadows, mountain slopes.	3,4,5	3,4,5	2,3
Viola selkirkii	G5?	S3	C	Circumpolar, boreal with large gaps in distribution.	Disj. populations in Chugach Mts., northern PWS, Valdez area.	Subalpine meadows, open forest, mountain slopes, steep rocky areas.	1,3,4	1,2,3, 4	3,4,5
Viola sempervirens	G5	S1	C	Chugach, disj. to southeast AK, BC, WA, OR.	W range edge in insular PWS, disj.	Alpine meadows.	4	3	2

Global Rankings (G RANK)

G1: Critically imperiled globally.
G2: Imperiled globally.
G3: Either very rare and local throughout its range or found locally in a restricted range.
G4: Apparently secure globally.
G5: Demonstrably secure globally.
GH: Species based on historical collections, possibly extinct.
G#Q: Taxonomically questionable.
G#T#: Global rank of species and global rank of the described variety or subspecies of the species.
G#G#: Global rank of species uncertain, best described as a range between the two ranks.

State Rankings (S RANK)

S1: Critically imperiled in the state because of extreme rarity or some factor(s) making it especially vulnerable to extirpation from the state.
S2: Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state.
S3: Rare or uncommon in the state.
S4: Apparently secure in the state, with many occurrences.
S5: Demonstrably secure in the state, with many occurrences.
SH: Species based on historical collections, possibly extinct.
SR#: Reported from the state, but not yet verified.
SP: Occurring nearby the state or province; not yet reported in the state, but probably will be encountered with further inventory.
S#S#: State rank uncertain, best described as a range between two ranks.

Sensitive/Species Of Concern

S Forest Service sensitive designation.
C Potential viability concern per NFMA

Distributions

Disj Disjunct population
PWS Prince William Sound
QCI Queen Charlotte Islands
NA North America
NWC Pacific Northwest Coast

Environmental Consequences

Plants of Conservation Concern, including Sensitive Plants

The purpose of this analysis is to evaluate how activities associated with Plan alternatives may affect the viability and distribution of plants with potential conservation concerns. Table 3-41 lists these plants along with reasons for conservation concern. The Affected Environment section discusses how plants were selected for this analysis.

Table 3-41: Plants of conservation concern, and reason for concern.

PLANT NAME	REASON FOR CONSERVATION CONCERN
Adiantum aleuticum	Rare in Chugach, disjunct populations, edge of range in Chugach.
Agrostis thurberiana	Rare in Alaska, disjunct population, edge of range in Chugach.
Anemone multifida var. *saxicola*	Edge of range in Chugach.
Aphragmus eschscholtzianus	Sensitive species, rare, regional endemic.
Arnica diversifolia	Rare in Alaska, edge of range in Chugach.
Arnica lessingii ssp. *norbergii*	Sensitive species, rare, regional endemic.
Artemisia tilesii var. *unalaschcensis*	Rare, edge of range in Chugach.
Botrychium ascendens	Rare.
Botrychium virginianum	Rare in Alaska, disjunct population, edge of range in Chugach.
Botrychium new 2x	Unnamed species, rare.
Botrychium new 4x	Unnamed species, rare.
Carex athrostachya	Rare in Alaska, disjunct population.
Carex lenticularis var. *dolia*	Sensitive species, propose de-listing as sensitive.
Carex phaeocephala	Rare in Alaska, edge of range near Chugach.
Carex preslii	Rare in Alaska.
Carex ramenskii	Edge of range in Chugach.
Carex stipitata	Rare in Alaska, disjunct population.
Castilleja parviflora	Edge of range in Chugach.
Coptis aspleniifolia	Edge of range in Chugach.
Crataegus douglasii var. *douglasii*	Rare in Alaska, disjunct population, edge of range in Chugach.
Dactylorhiza aristata	Edge of range in Chugach.
Delphinium brachycentrum	Edge of range in Chugach.
Dianthus repens	Disjunct population, edge of range in Chugach.
Douglasia alaskana	Rare, disjunct population, edge of range in Chugach.
Draba kananaskis	Sensitive species, rare, disjunct population, edge of range in Chugach.
Eleocharis kamtschatica	Rare in Alaska, disjunct population.
Eriophorum viridi-carinatum	Rare in Alaska, edge of range in Chugach.
Geum aleppicum var. *strictum*	Rare, edge of range in Chugach.
Isoetes truncata	Sensitive species, rare.
Isoetes occidentalis	Rare in Alaska, suspected disjunct population.
Ligusticum calderi	Sensitive species, rare, edge of range suspected in Chugach.
Lonicera involucrata	Rare in Alaska, disjunct population, edge of range in Chugach.
Maianthemum stellatum	Rare in Alaska, disjunct population, edge of range in Chugach.
Oenanthe sarmentosa	Edge of range in Chugach.
Osmorhiza depauperata	Rare in Alaska, edge of range in Chugach.
Papaver alboroseum	Sensitive species, rare in Alaska, edge of range suspected in Chugach.
Papaver radicatum ssp. *alaskanum*	Edge of range in Chugach.
Pedicularis macrodonta	Rare in Alaska, edge of range in Chugach.
Piperia unalascensis	Rare in Alaska, disjunct populations.
Platanthera hyperborea var. *viridiflora*	Edge of range in Chugach.
Poa douglasii ssp. *macrantha*	Rare in Alaska, edge of range in Chugach.
Potentilla diversifolia	Edge of range in Chugach.
Potentilla drummondii	Rare in Alaska, edge of range in Chugach.
Primula eximia	Disjunct populations.
Puccinellia glabra	Sensitive species, rare, endemic.

Table 3-41: Plants of conservation concern, and reason for concern.

PLANT NAME	REASON FOR CONSERVATION CONCERN
Puccinellia triflora	Rare, endemic.
Ranunculus cooleyae	Edge of range in Chugach.
Romanzoffia unalaschcensis	Sensitive species, rare, regional endemic.
Salix hookeriana	Rare in Alaska, edge of range in Chugach.
Salix setchelliana	Rare in Alaska, edge of range in Chugach.
Saxifraga adscendens ssp. *oregonensis*	Rare in Alaska, edge of range near Chugach.
Scirpus rufus	Rare in Alaska, edge of range near Chugach.
Selaginella sibirica	Disjunct populations, edge of range in Chugach.
Senecio pauciflorus	Edge of range in Chugach.
Stellaria alaskana	Rare, disjunct populations, edge of range in Chugach.
Stellaria ruscifolia ssp. *aleutica*	Sensitive species, rare, regional endemic.
Taraxacum carneocoloratum	Rare, endemic, edge of range in Chugach.
Thlaspi arcticum	Rare, edge of range in Chugach.
Veronica wormskjoldii var. *stelleri*	Edge of range in Chugach.
Viola selkirkii	Rare in Alaska, disjunct populations.
Viola sempervirens	Rare in Alaska, disjunct populations, edge of range in Chugach.

The first step in this environmental consequences analysis was to review the general habitat information for each plant and to group the plants according to habitat. This grouping was done to facilitate analysis. Most of the plants discussed here occur in more than one habitat. A grid (Table 3-42) displays the plants and their potential habitats. The habitat information is very general, because the habitat and distribution information available for these plants in the Chugach is relatively scanty. However, even this small amount of information is helpful in organizing species into general habitats.

Table 3-42: Plants of conservation concern and their potential general habitats.

PLANT NAME	HABITAT	Sandy beach and below high tide	Upper beach meadow	Meadow	Gravelly, dry meadow	Shrubby areas	Open forest	Bog or muskeg	Riparian	Marshy areas	Lake and pond margins	Subalpine	Alpine	Rock faces	Scree/talus slopes
Adiantum aleuticum	Moist forested ravines, wet cliffs, rock faces, talus slopes, alpine, and subalpine meadows.			X			X		X		X	X	X	X	X
Agrostis thurberiana	Alpine meadows, bogs, stream margins, lake margins.							X	X		X	X	X		
Anemone multifida var. *saxicola*	Rocky slopes, meadows, well drained soil, gravelly areas			X	X							X			X

Table 3-42: Plants of conservation concern and their potential general habitats.

PLANT NAME	HABITAT	Sandy beach and below high tide	Upper beach meadow	Meadow	Gravelly, dry meadow	Shrubby areas	Open forest	Bog or muskeg	Riparian	Marshy areas	Lake and pond margins	Subalpine	Alpine	Rock faces	Scree/talus slopes
Aphragmus eschscholtzianus	Moist mossy areas, solifluction slopes, near rivulets in alpine seeps, heaths and scree slopes in the subalpine and alpine											X	X		X
Arnica diversifolia	Rocky gravelly areas, open areas, grassy meadows, mountains, mixed herbaceous meadows			X	X							X			
Arnica lessingii ssp. *norbergii*	From sea level to subalpine in well drained meadows, shrublands, dry meadows, forest openings and open forest.			X	X	X									
Artemisia tilesii var. *unalaschcensis*	Well-drained areas, sandy soil, alpine, lowlands.				X	X						X	X		
Botrychium ascendens	Beach meadows sandy areas. Mesic to dry meadows in the alpine.	X	X		X										
Botrychium virginianum	Shrubby grassy areas, thickets, upper beach meadows.		X	X		X									
Botrychium sp. new 2x	Beach meadows sandy areas, open turfy or gravelly slopes, shores or meadows.	X	X		X										
Botrychium sp. new 4x	Beach meadows sandy areas, open turfy or gravelly slopes, shores or meadows.	X	X		X										
Carex athrostachya	Wet meadows, lowlands to moderate elevations.		X	X								X			

Table 3-42: Plants of conservation concern and their potential general habitats.

PLANT NAME	HABITAT	Sandy beach and below high tide	Upper beach meadow	Meadow	Gravelly, dry meadow	Shrubby areas	Open forest	Bog or muskeg	Riparian	Marshy areas	Lake and pond margins	Subalpine	Alpine	Rock faces	Scree/talus slopes
Carex lenticularis var. *dolia*	Wet meadows, along lakeshores and snowbeds, generally at high elevations, subalpine, alpine.										X	X	X		
Carex phaeocephala	Wet meadows, rocky alpine slopes.			X								X	X		
Carex preslii	Meadows.			X											
Carex ramenskii	Coastal salt marsh, brackish water, beaches at high tide.	X	X												
Carex stipitata	Swamps and meadows, pond edges, wet low ground.			X						X	X				
Castilleja parviflora	Alpine and subalpine meadows.											X	X		
Coptis aspleniifolia	Bog edges, mixed conifer forests, open forests.						X	X							
Crataegus douglasii var. *douglasii*	Forest edge.		X												
Dactylorhiza aristata	Meadows, mountain slopes, dry rocky heath.		X	X								X			
Delphinium brachycentrum	Well-drained tundra slopes.											X	X		
Dianthus repens	Sandy, gravelly, and rocky places, talus slopes, herbaceous meadows.			X	X							X			X
Douglasia alaskana	Rocky or sandy sites in subalpine and alpine.											X	X		X
Draba kananaskis	Dry alpine, rocky ledges and slopes.												X	X	X
Eleocharis kamtschatica	Marshes, wet meadows, bog margins. In lowlands, brackish water, upper beaches.		X	X				X		X					

Table 3-42: Plants of conservation concern and their potential general habitats.

PLANT NAME	HABITAT	Sandy beach and below high tide	Upper beach meadow	Meadow	Gravelly, dry meadow	Shrubby areas	Open forest	Bog or muskeg	Riparian	Marshy areas	Lake and pond margins	Subalpine	Alpine	Rock faces	Scree/talus slopes
Eriophorum viridi-carinatum	Rich bogs and meadows.		X					X							
Geum aleppicum var. *strictum*	Meadows and thickets. Grassy clearings.			X		X									
Isoetes truncata	Immersed in shallow fresh water pools or ponds.										X				
Isoetes occidentalis	Immersed in shallow fresh water pools or ponds.										X				
Ligusticum calderi	Alpine and subalpine meadows.											X			
Lonicera involucrata	Beach meadow ecotones, forest edges.		X				X								
Maianthemum stellatum	Meadows, well drained dryer areas, open forests, lakeshores.			X	X		X				X				
Oenanthe sarmentosa	Marshes, sluggish water, wet grassy herbaceous areas.			X						X	X				
Osmorhiza depauperata	Deciduous forests, on floodplains.		X				X		X						
Papaver alboroseum	Open areas, recently deglaciated areas, rock outcrops, sand, gravel, and on well-drained soils.				X				X						
Papaver radicatum ssp. *alaskanum*	Sandy, gravelly soil, rocky tundra.				X							X	X		
Pedicularis macrodonta	Swamps, muskegs, wet meadows.			X				X		X					
Piperia unalascensis	Meadows, bog edges.		X	X				X							
Platanthera hyperborea var. *viridiflora*	Wet meadows, herbaceous back beaches, wet seepage slopes.		X	X											

Table 3-42: Plants of conservation concern and their potential general habitats.

PLANT NAME	HABITAT	Sandy beach and below high tide	Upper beach meadow	Meadow	Gravelly, dry meadow	Shrubby areas	Open forest	Bog or muskeg	Riparian	Marshy areas	Lake and pond margins	Subalpine	Alpine	Rock faces	Scree/talus slopes
Poa douglasii ssp. *macrantha*	Sandy maritime beaches and meadows. Herbaceous meadows in sandy soil.	X	X												
Potentilla diversifolia	Alpine meadows and slopes, solifluction soil. Open rocky slopes.											X	X		
Potentilla drummondii	Alpine-subalpine meadows											X			
Primula eximia	Alpine meadows. late snowbeds.												X		
Puccinellia glabra	Maritime beaches, coastal wetlands.	X													
Puccinellia triflora	Maritime beaches, coastal wetlands.	X													
Ranunculus cooleyae	Alpine and subalpine meadows.											X	X		
Romanzoffia unalaschcensis	Cracks in rock outcrops, along stream banks, beach terraces, open rocky areas and on grassy, mossy rock cliffs along shores, "bird rocks" maritime sea cliffs.		X											X	
Salix hookeriana	Stabilized sand dunes, pond edges.		X								X				
Salix setchelliana	Pioneer on moist to mesic, sandy to gravelly sites along glacial rivers and on glacial moraines in the montane zone.			X	X				X			X			
Saxifraga adscendens ssp. *oregonensis*	Rocky crevices in mountains, moist gravelly rocky areas, alpine meadows.											X	X		
Scirpus rufus	Saline soil, maritime beaches.	X													

Table 3-42: Plants of conservation concern and their potential general habitats.

PLANT NAME	HABITAT	Sandy beach and below high tide	Upper beach meadow	Meadow	Gravelly, dry meadow	Shrubby areas	Open forest	Bog or muskeg	Riparian	Marshy areas	Lake and pond margins	Subalpine	Alpine	Rock faces	Scree/talus slopes
Selaginella sibirica	Open grassy tundra, dry alpine, dry exposed rocks and ledges, rocky slopes.											X	X		
Senecio pauciflorus	Alpine meadows, lakeshores.										X	X	X		
Stellaria alaskana	Alpine tundra and scree slopes.												X		X
Stellaria ruscifolia ssp. *aleutica*	Open gravely sites, and along creeks in the mountains. and in lowlands in same habitat.				X				X			X			
Taraxacum carneocoloratum	Alpine talus and scree slopes.												X		X
Thlaspi arcticum	Alpine, gravels, talus, rock outcrops.												X	X	X
Veronica wormskjoldii var. *stelleri*	Meadows, mountain slopes.			X								X			
Viola selkirkii	Subalpine meadows, open forest, mountain slopes, steep rocky areas.						X					X		X	
Viola sempervirens	Alpine meadows.											X	X		

A table was also developed to show which of the elements (risk factors) from the Management Prescription Activity Matrix may affect the various general habitats and the plants associated with those habitats. These risk factors are displayed in the grid shown in Table 3-43.

Table 3-43: Potential risk factors to plant species of conservation concern by habitat.

	General habitats													
Potential Risks to Plants (from Activity Matrix)	**Sandy beach and below high tide**	**Upper beach meadow**	**Meadow**	**Gravelly, dry meadow**	**Shrubby areas**	**Open forest**	**Bog or muskeg**	**Riparian**	**Marshy areas**	**Lake and pond margins**	**Subalpine**	**Alpine**	**Rock faces**	**Scree / talus slopes**
FS vegetation management		X	X	X	X	X								
FS fish habitat projects								X	X	X				
Pest management						X		X						
Invasion by exotic plants	X	X	X	X	X	X		X		X				
Prescribed fire				X	X	X								
Timber harvest						X		X		X				
Commercial special forest products	X	X	X	X	X	X	X	X	X	X	X			
Personal use special forest products	X	X	X	X	X	X	X	X	X	X	X	X	X	
Minerals activities				X	X	X		X		X	X	X	X	X
Recreational gold panning								X		X	X	X	X	X
OHV designated routes, summer	X			X	X	X	X	X		X	X	X		
OHV other purposes	X	X	X	X	X	X	X	X	X	X	X	X		X
Nonmotorized recreation use, hiking camping	X	X	X	X	X	X	X	X		X	X	X	X	X
Day use facilities		X		X				X		X				
FS recreational cabins		X	X	X	X	X	X			X				
Campgrounds		X	X	X	X	X		X		X	X			
Hardened dispersed camping	X	X	X	X	X	X		X		X	X	X		
Marine transfer facilities	X	X												
Boat docks and ramps	X	X							X	X				
Mode changes: parking lots at trailheads, ferry terminals, etc.	X	X	X	X	X	X		X		X	X			
New roads	X	X	X	X	X	X	X	X	X	X	X			
New trails		X	X	X	X	X	X	X	X	X	X	X		X
Trail reconstruction		X	X	X	X	X	X	X	X	X	X	X		X
Electronic sites											X	X		
SUP storage areas (fisheries)	X	X	X	X									X	
Utility systems	X	X	X		X	X	X	X	X	X	X		X	X
SUP helicopter landings summer	X	X	X	X	X		X	X		X	X	X		
SUP fixed wing flightseeing landings	X	X		X	X			X		X				
SUP guided hiking and climbing	X	X	X	X	X	X	X	X		X	X	X	X	X
SUP destination lodges		X		X	X	X		X		X	X			
Non-FS SUP cabins		X	X	X	X	X		X		X	X			
SUP recreation equipment cache		X	X	X	X	X				X	X			

Using this information, plants and risk were sorted by general habitat (Table 3-44). This table provides a picture of how many plants of concern occur in the different habitats, and shows which of the risk factors might affect the plants or their habitats.

Table 3-44: General habitats and associated plants of conservation concern and their potential risks.

SANDY BEACH & BELOW HIGH TIDE	
Plants	**Risks**
Botrychium ascendens	*Boat docks and ramps*
Botrychium sp. new 2x	*Commercial special forest products*
Botrychium sp. new 4x	*Hardened dispersed camping*
Carex ramenskii	*Invasion by exotic plants*
Poa douglasii ssp. macrantha	*Marine transfer facilities*
Puccinellia glabra	*Mode changes: parking lots at trailheads, ferry terminals, etc.*
Puccinellia triflora	*New roads*
Scirpus rufus	*Nonmotorized recreation use, hiking camping*
	OHV designated routes, summer
	OHV other purposes
	Personal use special forest products
	SUP fixed-wing flightseeing landings
	SUP guided hiking and climbing
	SUP helicopter landings summer
	SUP storage areas (fisheries)
	Utility systems
UPPER BEACH MEADOW	
Plants	**Risks**
Botrychium ascendens	*Boat docks and ramps*
Botrychium sp new 2x	*Campgrounds*
Botrychium sp new 4x	*Commercial special forest products*
Botrychium virginianum	*Day use facilities*
Carex athrostachya	*FS recreational cabins*
Carex ramenskii	*FS vegetation management*
Crataegus douglasii var. douglasii	*Hardened dispersed camping*
Dactylorhiza aristata	*Invasion by exotic plants*
Eleocharis kamtschatica	*Marine transfer facilities*
Eriophorum viridi-carinatum	*Mode changes: parking lots at trailheads, ferry terminals, etc.*
Lonicera involucrata	*New roads*
Osmorhiza depauperata	*New trails*
Piperia unalascensis	*Non-FS SUP cabins*
Platanthera hyperborea var. viridiflora	*Nonmotorized recreation use, hiking camping*
Poa douglasii ssp. macrantha	*OHV other purposes*
Romanzoffia unalaschcensis	*Personal use special forest products*
Salix hookeriana	*SUP destination lodges*
	SUP fixed-wing flightseeing landings
	SUP guided hiking and climbing
	SUP helicopter landings summer
	SUP rec. equipment cache
	SUP storage areas (fisheries)
	Trail reconstruction
	Utility systems

Table 3-44: General habitats and associated plants of conservation concern and their potential risks.

MEADOW	
Plants	**Risks**
Adiantum aleuticum	*Campgrounds*
Anemone multifida var. saxicola	*Commercial special forest products*
Arnica diversifolia	*FS recreational cabins*
Arnica lessingii ssp. norbergii	*FS vegetation management*
Botrychium virginianum	*Hardened dispersed camping*
Carex athrostachya	*Invasion by exotic plants*
Carex phaeocephala	*Mode changes: parking lots at trailheads, ferry terminals, etc.*
Carex preslii	
Carex stipitata	*New roads*
Dactylorhiza aristata	*New trails*
Dianthus repens	*Non-FS SUP cabins*
Eleocharis kamtschatica	*Nonmotorized recreation use, hiking camping*
Geum aleppicum var. strictum	*OHV other purposes*
Maianthemum stellatum	*Personal use special forest products*
Oenanthe sarmentosa	*SUP guided hiking and climbing*
Pedicularis macrodonta	*SUP helicopter landings summer*
Piperia unalascensis	*SUP rec. equipment cache*
Platanthera hyperborea var. viridiflora	*SUP storage areas (fisheries)*
Salix setchelliana	*Trail reconstruction*
Veronica wormskjoldii var. stelleri	*Utility systems*

GRAVELLY, DRY MEADOW	
Plants	**Risks**
Anemone multifida var. saxicola	*Campgrounds*
Arnica diversifolia	*Commercial special forest products*
Arnica lessingii ssp. norbergii	*Day use facilities*
Artemisia tilesii var. unalaschcensis	*FS recreational cabins*
Botrychium ascendens	*FS vegetation management*
Botrychium sp new 2x	*Hardened dispersed camping*
Botrychium sp new 4x	*Invasion by exotic plants*
Dianthus repens	*Minerals activities*
Maianthemum stellatum	*Mode changes: parking lots at trailheads, ferry terminals, etc.*
Papaver alboroseum	
Papaver radicatum ssp. alaskanum	*New roads*
Salix setchelliana	*New trails*
Stellaria ruscifolia ssp. aleutica	*Non-FS SUP cabins*
	Nonmotorized recreation use, hiking camping
	OHV designated routes, summer
	OHV other purposes
	Personal use special forest products
	Prescribed fire
	SUP destination lodges
	SUP fixed-wing flightseeing landings
	SUP guided hiking and climbing
	SUP helicopter landings summer
	SUP recreation equipment cache
	SUP storage areas (fisheries)
	Trail reconstruction

Table 3-44: General habitats and associated plants of conservation concern and their potential risks.

SHRUBBY AREAS	
Plants	**Risks**
Arnica lessingii ssp. norbergii *Artemisia tilesii var. unalaschcensis* *Botrychium virginianum* *Geum aleppicum var. strictum*	*Campgrounds* *Commercial special forest products* *FS recreational cabins* *FS vegetation management* *Hardened dispersed camping* *Invasion by exotic plants* *Minerals activities* *Mode changes: parking lots at trailheads, ferry terminals, etc.* *New roads* *New trails* *Non-FS SUP cabins* *Nonmotorized recreation use, hiking camping* *OHV designated routes, summer* *OHV other purposes* *Personal use special forest products* *Prescribed fire* *SUP destination lodges* *SUP fixed-wing flightseeing landings* *SUP guided hiking and climbing* *SUP helicopter landings summer* *SUP rec. equipment cache* *Trail reconstruction* *Utility systems*

OPEN FOREST	
Plants	**Risks**
Adiantum aleuticum *Coptis aspleniifolia* *Lonicera involucrata* *Maianthemum stellatum* *Osmorhiza depauperata* *Viola selkirkii*	*Campgrounds* *Commercial special forest products* *FS recreational cabins* *FS vegetation management* *Hardened dispersed camping* *Invasion by exotic plants* *Minerals activities* *Mode changes: parking lots at trailheads, ferry terminals, etc.* *New roads* *New trails* *Non-FS SUP cabins* *Nonmotorized recreation use, hiking camping* *OHV designated routes, summer* *OHV other purposes* *Personal use special forest products* *Pest management* *Prescribed fire* *SUP destination lodges* *SUP guided hiking and climbing* *SUP rec. equipment cache* *Timber harvest* *Trail reconstruction* *Utility systems*

Table 3-44: General habitats and associated plants of conservation concern and their potential risks.

BOG OR MUSKEG	
Plants	**Risks**
Coptis aspleniifolia *Eleocharis kamtschatica* *Eriophorum viridi-carinatum* *Pedicularis macrodonta* *Piperia unalascensis*	*Commercial special forest products* *FS recreational cabins* *New roads* *New trails* *Nonmotorized recreation use, hiking camping* *OHV designated routes, summer* *OHV other purposes* *Personal use special forest products* *SUP guided hiking and climbing* *SUP helicopter landings summer* *Trail reconstruction* *Utility systems*

RIPARIAN	
Plants	**Risks**
Adiantum aleuticum *Agrostis thurberiana* *Osmorhiza depauperata* *Papaver alboroseum* *Salix setchelliana* *Stellaria ruscifolia ssp. aleutica*	*Campgrounds* *Commercial special forest products* *Day use facilities* *FS fish habitat projects* *FS recreational cabins* *Hardened dispersed camping* *Invasion by exotic plants* *Minerals activities* *Mode changes: parking lots at trailheads, ferry terminals, etc.* *New roads* *New trails* *Non-FS SUP cabins* *Nonmotorized recreation use, hiking camping* *OHV designated routes, summer* *OHV other purposes* *Personal use special forest products* *Pest management* *Recreational gold panning* *SUP destination lodges* *SUP fixed-wing flightseeing landings* *SUP guided hiking and climbing* *SUP helicopter landings summer* *Timber harvest* *Trail reconstruction* *Utility systems*

Table 3-44: General habitats and associated plants of conservation concern and their potential risks.

MARSHY AREAS	
Plants	**Risks**
Carex stipitata *Eleocharis kamtschatica* *Oenanthe sarmentosa* *Pedicularis macrodonta*	*Boat docks and ramps* *Commercial special forest products* *FS fish habitat projects* *New roads* *New trails* *OHV other purposes* *Personal use special forest products* *Trail reconstruction* *Utility systems*
LAKE & POND MARGINS	
Plants	**Risks**
Adiantum aleuticum *Agrostis thurberiana* *Carex lenticularis var. dolia* *Carex stipitata* *Isoetes occidentalis* *Isoetes truncata* *Maianthemum stellatum* *Oenanthe sarmentosa* *Salix hookeriana* *Senecio pauciflorus*	*Boat docks and ramps* *Campgrounds* *Commercial special forest products* *Day use facilities* *FS fish habitat projects* *FS recreational cabins* *Hardened dispersed camping* *Invasion by exotic plants* *Minerals activities* *Mode changes: parking lots at trailheads, ferry terminals, etc.* *New roads* *New trails* *Non-FS SUP cabins* *Nonmotorized recreation use, hiking camping* *OHV designated routes, summer* *OHV other purposes* *Personal use special forest products* *Recreational gold panning* *SUP destination lodges* *SUP fixed-wing flightseeing landings* *SUP guided hiking and climbing* *SUP helicopter landings summer* *SUP rec. equipment cache* *Timber harvest* *Trail reconstruction* *Utility systems*

Table 3-44: General habitats and associated plants of conservation concern and their potential risks.

SUBALPINE	
Plants	**Risks**
Adiantum aleuticum	*Campgrounds*
Agrostis thurberiana	*Commercial special forest products*
Anemone multifida var. saxicola	*Electronic sites*
Aphragmus eschscholtzianus	*Hardened dispersed camping*
Arnica diversifolia	*Minerals activities*
Artemisia tilesii var. unalaschcensis	*Mode changes: parking lots at trailheads, ferry terminals, etc.*
Carex athrostachya	*New roads*
Carex lenticularis var. dolia	*New trails*
Carex phaeocephala	*Non-FS SUP cabins*
Castilleja parviflora	*Nonmotorized recreation use, hiking camping*
Dactylorhiza aristata	*OHV designated routes, summer*
Delphinium brachycentrum	*OHV other purposes*
Dianthus repens	*Personal use special forest products*
Douglasia alaskana	*Recreational gold panning*
Ligusticum calderi	*SUP destination lodges*
Papaver radicatum ssp. alaskanum	*SUP guided hiking and climbing*
Potentilla diversifolia	*SUP helicopter landings summer*
Potentilla drummondii	*SUP rec. equipment cache*
Ranunculus cooleyae	*Trail reconstruction*
Salix setchelliana	*Utility systems*
Saxifraga adscendens ssp. oregonensis	
Selaginella sibirica	
Senecio pauciflorus	
Stellaria ruscifolia ssp. aleutica	
Veronica wormskjoldii var. stelleri	
Viola selkirkii	
Viola sempervirens	
ALPINE	
Plants	**Risks**
Adiantum aleuticum	*Electronic sites*
Agrostis thurberiana	*Hardened dispersed camping*
Aphragmus eschscholtzianus	*Minerals activities*
Artemisia tilesii var. unalaschcensis	*New trails*
Carex lenticularis var. dolia	*Nonmotorized recreation use, hiking camping*
Carex phaeocephala	*OHV designated routes, summer*
Castilleja parviflora	*OHV other purposes*
Delphinium brachycentrum	*Personal use special forest products*
Douglasia alaskana	*Recreational gold panning*
Draba kananaskis	*SUP guided hiking and climbing*
Papaver radicatum ssp. alaskanum	*SUP helicopter landings summer*
Potentilla diversifolia	*Trail reconstruction*
Primula eximia	
Ranunculus cooleyae	
Saxifraga adscendens ssp. oregonensis	
Selaginella sibirica	
Senecio pauciflorus	
Stellaria alaskana	
Taraxacum carneocoloratum	
Thlaspi arcticum	
Viola sempervirens	

Table 3-44: General habitats and associated plants of conservation concern and their potential risks.

ROCK FACES	
Plants	**Risks**
Adiantum aleuticum	*Minerals activities*
Draba kananaskis	*Nonmotorized recreation use, hiking camping*
Romanzoffia unalaschcensis	*Personal use special forest products*
Thlaspi arcticum	*Recreational gold panning*
Viola selkirkii	*SUP guided hiking and climbing*
	SUP storage areas (fisheries, beach rocks)
	Utility systems

SCREE/TALUS SLOPES	
Plants	**Risks**
Adiantum aleuticum	*Minerals activities*
Anemone multifida var. saxicola	*New trails*
Aphragmus eschscholtzianus	*Nonmotorized recreation use, hiking camping*
Dianthus repens	*OHV other purposes*
Douglasia alaskana	*Recreational gold panning*
Draba kananaskis	*SUP guided hiking and climbing*
Stellaria alaskana	*Trail reconstruction*
Taraxacum carneocoloratum	*Utility systems*
Thlaspi arcticum	

As shown in Table 3-44, activities associated with an array of risks could potentially result in direct as well as indirect effects to individual plants of conservation concern, populations of these plants or their general habitat. Risks remain essentially the same for each alternative because of the Forest's large size and intricate mosaic of habitats and prescriptions. However, proposed management including habitat alteration in these habitats is minimal, since such a small amount of the habitat might be directly or indirectly affected by the risks. Therefore, the consequences of the effects of these potential risks on the plants and their habitat are minimal. In addition, Laws, Regulation, Policy, a combination of land allocations and Forestwide standards and guidelines will be applied to sustain plants of conservation concern and their habitat, no matter which alternative is selected. Therefore, there is a low likelihood of effects to the plants or their habitat as the result of any alternative.

On account of these factors, the likelihood of risk to the viability of the plants of conservation concern is low because habitat is of sufficient quality, similar to expected range and abundance to allow the plants to continue maintaining well-distributed reproducing populations across the Forest.

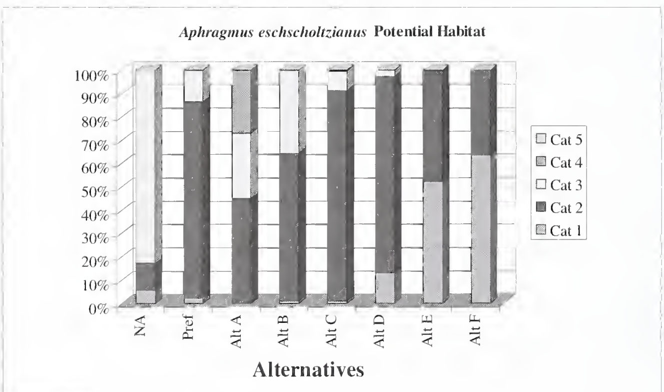
Sensitive Plant Species

The Alaska Region Sensitive Species List was first established in 1990, and a technical revision was completed in 1994 when 22 plants and Queen Charlotte goshawk were added. The list was revised in 1999 when four plants were removed from the list. There are 18 plants designated as sensitive species within the Alaska Region. Ten plants are known or suspected to occur on the Chugach National Forest. The next section discusses the effect of the

alternatives on the ten Regional sensitive plants found on the Chugach National Forest.

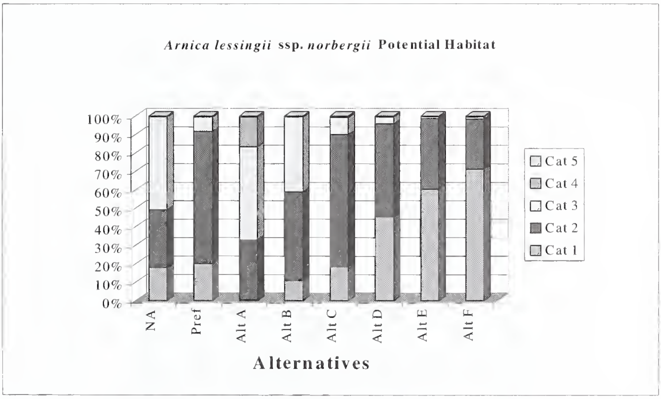
Aphragmus eschscholtzianus, (Eschscholtz's little nightmare). The potential habitats of the plant are moist mossy areas, solifluction slopes, seeps, heaths and scree slopes in subalpine and alpine areas. The *Aphragmus* or its habitat could be affected by activities relating to campgrounds, commercial special forest products, electronic sites, hardened dispersed camping, minerals activities, mode changes such as parking lots at trailheads, new roads, new trails, cabins, nonmotorized recreation use, hiking, camping, OHV designated routes, summer OHV other purposes, personal use special forest products, recreational gold panning, SUP destination lodges, guided hiking and climbing, helicopter landings summer, recreational equipment cache, trail reconstruction, or utility systems. The likelihood of these activities affecting the viability of the plant on the Forest is low because the plant occurs in generally remote alpine areas where the potential for these activities is low. The differences between the potential effects of the alternatives are displayed in the Figure 3-27. In addition, laws, regulation, policy, a combination of land allocations and Forestwide standards and guidelines will be applied to sustain the plant and its habitat. Therefore, any alternative may affect individuals but is not likely to contribute to a loss of viability.

Figure 3-27: Distribution of potential *Aphragmus eschscholtzianus* habitat on the Chugach National Forest by prescription category and alternative.



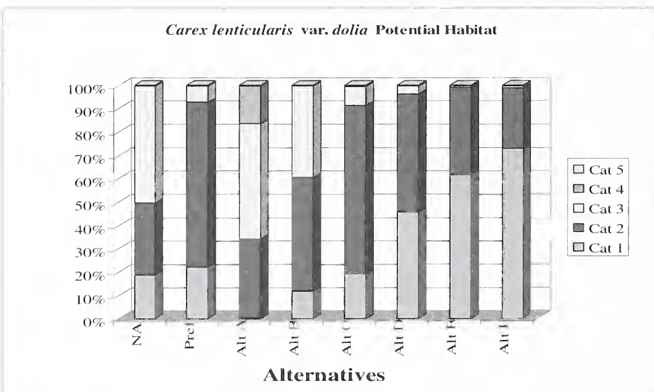
Arnica lessingii ssp. ***norbergii***, (Norberg Arnica). The potential habitats of the plant are well-drained and dry meadows, shrublands forest openings and open forest from sea level to subalpine. The *Arnica* or its habitat could be affected by activities relating to campgrounds, commercial special forest products, day use facilities, recreational cabins, vegetation management, hardened dispersed camping, invasion by exotic plants, minerals activities, mode changes: parking lots at trailheads, ferry terminals, new roads, new trails, cabins, nonmotorized recreation use, hiking camping, OHV designated routes, summer, OHV other purposes, personal use special forest products, prescribed fire, destination lodges, fixed-wing flightseeing landings, guided hiking and climbing, helicopter landings summer, recreational equipment cache, storage areas (fisheries), trail reconstruction, and utility systems. The differences between the potential effects of the alternatives are displayed in Figure 3-28. In addition, laws, regulation, policy, a combination of land allocations and Forestwide standards and guidelines will be applies to sustain the plant and its habitat. Therefore, any alternative may affect individuals but is not likely to contribute to a loss of viability.

Figure 3-28: Distribution of potential *Arnica lessingii* ssp. *norbergii* habitat on the Chugach National Forest by prescription category and alternative.



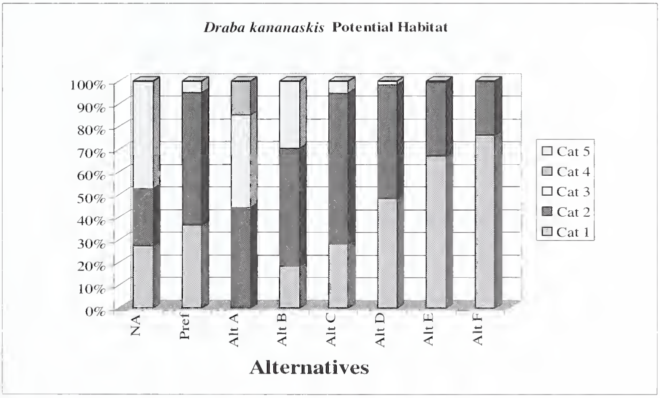
Carex lenticularis* var. *dolia, (Goose-grass Sedge). The potential habitats of the plant are pond and lake margins, wet meadows, and snowbeds in the subalpine and alpine. The *Carex* or its habitat could be affected by activities relating to boat docks and ramps, campgrounds, commercial special forest products, day use facilities, electronic sites, fish habitat projects, recreational cabins, hardened dispersed camping, invasion by exotic plants, minerals activities, mode changes: parking lots at trailheads, new roads, new trails, cabins, nonmotorized recreation use, hiking, camping, OHV designated routes, summer, OHV other purposes, personal use special forest products, recreational gold panning, destination lodges, guided hiking and climbing, helicopter landings summer, recreational equipment cache, trail reconstruction, utility systems. The likelihood of these activities affecting the viability of the plant in the Forest is low because the plant occurs in generally remote alpine areas where the potential for these activities is low. The differences between the potential effects of the alternatives are displayed in Figure 3-29. In addition, laws, regulation, policy, a combination of land allocations and Forestwide standards and guidelines will be applied to sustain the plant and its habitat. Therefore, any alternative may affect individuals but is not likely to contribute to a loss of viability. Recent taxonomic treatments have added *Carex enanderi* to this taxon. Thus, the plant is more abundant than before *Carex enanderi* was subsumed by *Carex lenticularis* var. *dolia*, thus further lowering the risk to this plant.

Figure 3-29: Distribution of potential *Carex lenticularis* var. *dolia* habitat on the Chugach National Forest by prescription category and alternative.



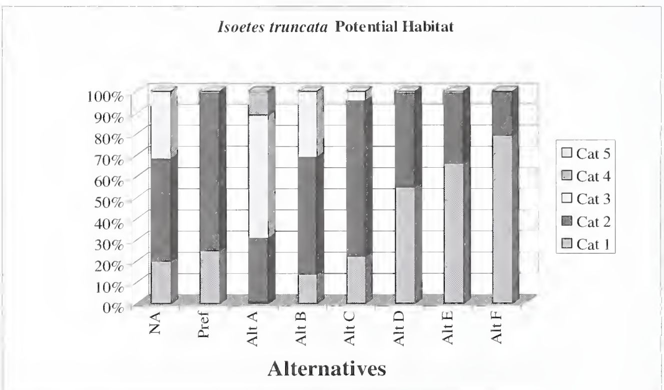
Draba kananaskis, (Tundra Whitlow-grass). The potential habitats of the plant are rocky ledges, dry areas and scree slopes in subalpine and alpine areas. The *Draba* or its habitat could be affected by activities relating to campgrounds, commercial special forest products, electronic sites, hardened dispersed camping, minerals activities, mode changes such as parking lots at trailheads, new roads, new trails, cabins, nonmotorized recreation use, hiking, camping, OHV designated routes, summer OHV other purposes, personal use special forest products, recreational gold panning, destination lodges, guided hiking and climbing, helicopter landings summer, recreational equipment cache, trail reconstruction, or utility systems. The likelihood of these activities affecting the viability of the plant on the Forest is low because the plant occurs in generally remote alpine areas where the potential for these activities is low. The differences between the potential effects of the alternatives are displayed in Figure 3-30. In addition, laws, regulation, policy, a combination of land allocations and Forestwide standards and guidelines will be applied to sustain the plant and its habitat. Therefore, any alternative may affect individuals but is not likely to contribute to a loss of viability.

Figure 3-30: Distribution of potential *Draba kananaskis* habitat on the Chugach National Forest by prescription category and alternative.



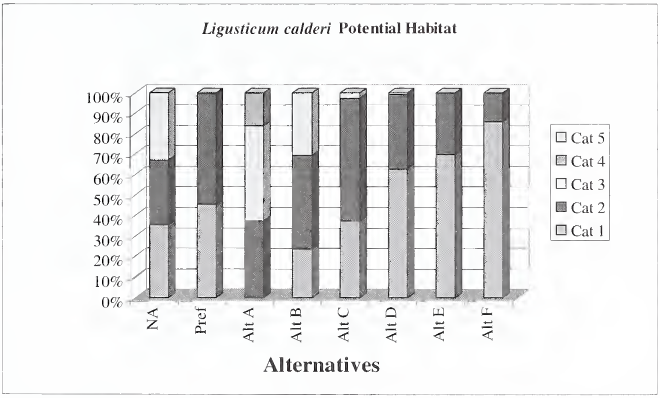
Isoetes truncata (***Isoetes x truncata***), (Truncate Quillwort). The habitat of the plant is the shallows of lakes and ponds, where it is generally immersed in freshwater. The *Isoetes* or its habitat could be affected by activities relating to boat docks and ramps, campgrounds, commercial special forest products, day use facilities, fish habitat projects, recreational cabins, hardened dispersed camping, invasion by exotic plants, minerals activities, mode changes: parking lots at trailheads, new roads, new trails, cabins, nonmotorized recreation use, hiking, camping, OHV designated routes, summer, OHV other purposes, personal use special forest products, recreational gold panning, destination lodges, guided hiking, recreational equipment cache, timber harvest, and utility systems. The differences between the potential effects of the alternatives are displayed in Figure 3-31. In addition, laws, regulation, policy, a combination of land allocations and Forestwide standards and guidelines will be applied to sustain the plant and its habitat. Therefore, any alternative may affect individuals but is not likely to contribute to a loss of viability.

Figure 3-31: Distribution of potential *Isoetes truncata* habitat on the Chugach National Forest by prescription category and alternative.



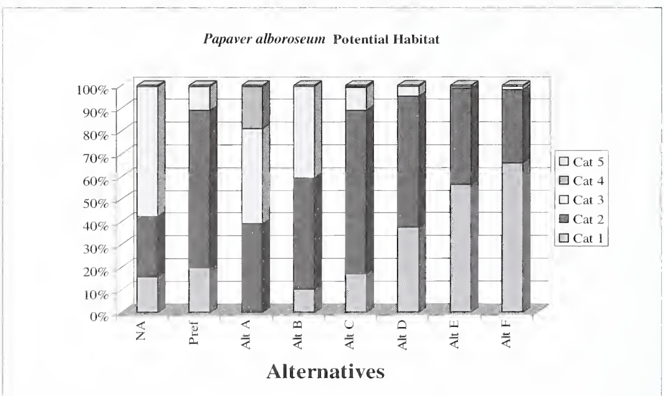
Ligusticum calderi, (Calder Lovage). The potential habitats of the plant are meadows in subalpine and alpine areas. The *Ligusticum* or its habitat could be affected by activities relating to campgrounds, commercial special forest products, electronic sites, hardened dispersed camping, minerals activities, mode changes such as parking lots at trailheads, new roads, new trails, cabins, nonmotorized recreation use, hiking, camping, OHV designated routes, summer OHV other purposes, personal use special forest products, recreational gold panning, destination lodges, guided hiking and climbing, helicopter landings summer, recreational equipment cache, trail reconstruction, or utility systems. The likelihood of these activities affecting the viability of the plant on the Forest is low because the plant occurs in generally remote subalpine and alpine areas where the potential for these activities is low. The differences between the potential effects of the alternatives are displayed in Figure 3-32. In addition, laws, regulation, policy, a combination of land allocations and Forestwide standards and guidelines will be applied to sustain the plant and its habitat. Therefore, any alterative may affect individuals but is not likely to contribute to a loss of viability.

Figure 3-32: Distribution of potential *Ligusticum calderi* habitat on the Chugach National Forest by prescription category and alternative.



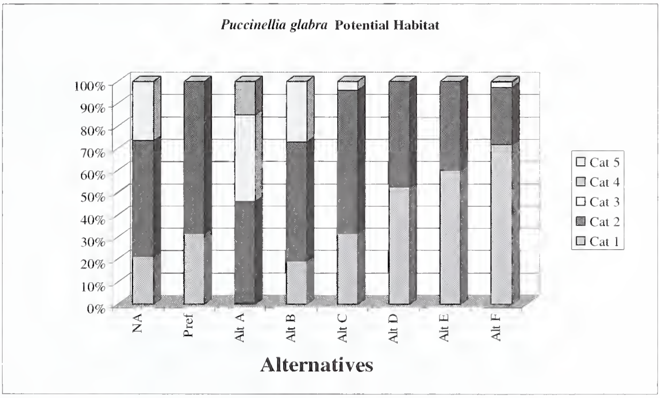
Papaver alboroseum, (Pale Poppy). The potential habitats of the plant are well drained open areas, recently deglaciated areas, rock outcrops, and sandy, gravelly areas and riparian areas. The *Papaver* or its habitat could be affected by activities relating to campgrounds, commercial special forest products, day use facilities, fish habitat projects, recreational cabins, vegetation management, hardened dispersed camping, invasion by exotic plants, minerals activities, mode changes: parking lots at trailheads, new roads, new trails, cabins, nonmotorized recreation use, hiking camping, OHV designated routes, summer, OHV other purposes, personal use special forest products, pest management, prescribed fire, recreational gold panning, destination lodges, fixed-wing flightseeing landings, guided hiking, helicopter landings summer, recreational equipment cache, or storage areas (fisheries), trail reconstruction, and utility systems. The differences between the potential effects of the alternatives are displayed in Figure 3-33. For individual project proposals, site-specific environmental analysis will include Biological Evaluations, which analyze the effects of those proposals on plants and animals and their habitats. As a result of the analysis, appropriate mitigation measures would be included in the project to sustain plant and animal species and their habitats. Therefore, any alternative may affect individuals but is not likely to contribute to a loss of viability.

Figure 3-33: Distribution of potential *Papaver alboroseum* habitat on the Chugach National Forest by prescription category and alternative.



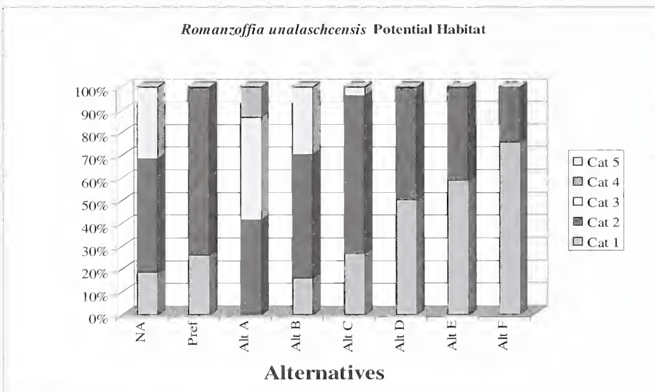
Puccinellia glabra, (Smooth Alkali Grass). The potential habitats of the plant are stabilized sandy, shingle or muddy beaches in the upper tidal zone. The *Puccinellia* or its habitat could be affected by activities relating to boat docks and ramps, invasion by exotic plants, marine transfer facilities, mode changes: parking lots at trailheads, ferry terminals, nonmotorized recreation use, hiking, OHV other purposes, personal use special forest products, fixed-wing flightseeing landings, guided hiking, storage areas (fisheries) and utility systems. The differences between the potential effects of the alternatives are displayed in Figure 3-34. In addition, laws, regulation, policy, a combination of land allocations and Forestwide standards and guidelines will be applied to sustain the plant and its habitat. Therefore, any alternative may affect individuals but is not likely to contribute to a loss of viability.

Figure 3-34: Distribution of potential *Puccinellia glabra* habitat on the Chugach National Forest by prescription category and alternative.



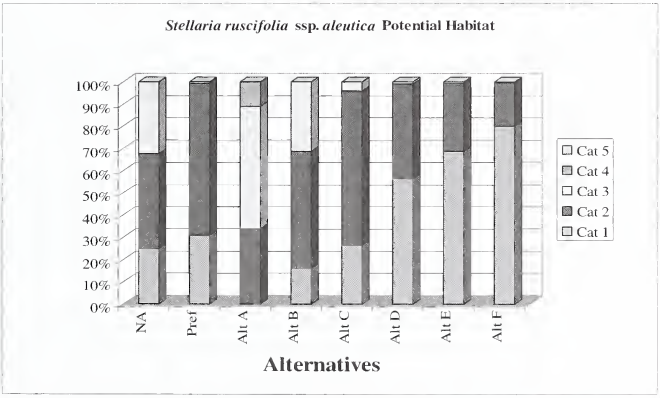
Romanzoffia unalaschcensis, (Mistmaiden). The potential habitats of the plant are rocky, cliffy areas along maritime beaches, or under maritime influence. The *Romanzoffia* or its habitat could be affected by activities relating to boat docks and ramps, campgrounds, commercial special forest products, day use facilities, recreational cabins, vegetation management, hardened dispersed camping, invasion by exotic plants, marine transfer facilities, minerals activities, mode changes: parking lots at trailheads, ferry terminals, new roads, new trails, cabins, nonmotorized recreation use, hiking camping, OHV designated routes, OHV other purposes, personal use special forest products, recreational gold panning, destination lodges, fixed-wing flightseeing landings, guided hiking and climbing, helicopter landings summer, recreational equipment cache, SUP storage areas (fisheries), trail reconstruction, and utility systems. The differences between the potential effects of the alternatives are displayed in Figure 3-35. In addition, laws, regulation, policy, a combination of land allocations and Forestwide standards and guidelines will be applied to sustain the plant and its habitat. Therefore, any alternative may affect individuals but is not likely to contribute to a loss of viability.

Figure 3-35: Distribution of potential *Romanzoffia unalaschcensis* habitat on the Chugach National Forest by prescription category and alternative.



Stellaria ruscifolia ssp. ***aleutica***, (Circumpolar Starwort). The potential habitats of the plant are open gravelly areas and along streams in lowlands and in the mountains. The *Stellaria* or its habitat could be affected by activities relating to campgrounds, commercial special forest products, day use facilities, electronic sites, fish habitat projects, recreational cabins, vegetation management, hardened dispersed camping, invasion by exotic plants, minerals activities, mode changes: parking lots at trailheads, ferry terminals, new roads, new trails, cabins, nonmotorized recreation use, hiking, camping, OHV designated routes, summer, OHV other purposes, personal use special forest products, pest management, prescribed fire, recreational gold panning, destination lodges, fixed-wing flightseeing landings, guided hiking and climbing, helicopter landings summer, recreational equipment cache, storage areas (fisheries), timber harvest, trail reconstruction and utility systems. The differences between the potential effects of the alternatives are displayed in Figure 3-36. In addition, laws, regulation, policy, a combination of land allocations and Forestwide standards and guidelines will be applied to sustain the plant and its habitat. Therefore, any alternative may affect individuals but is not likely to contribute to a loss of viability.

Figure 3-36: Distribution of potential *Stellaria ruscifolia* ssp. *aleutica* habitat on the Chugach National Forest by prescription category and alternative.



Wildlife

Introduction

The Organic Administration Act, the Multiple-Use/Sustained-Yield Act, the National Forest Management Act, the Sikes Act, and USDA and Forest Service policy and agreements recognize the shared responsibilities between the Forest Service and the Alaska Department of Fish and Game (ADF&G) in the management of fish and wildlife resources on the Chugach National Forest. These and other laws acknowledge State of Alaska jurisdiction in resident fish and wildlife management. The Forest Service indirectly affects population numbers, diversity and species viability through the management of habitat. The Alaska National Interest Lands Conservation Act (ANILCA) provides for the maintenance of sound populations of, and habitat for, wildlife species of value to the citizens of Alaska and the nation.

In recent decades, public interest and participation in nonconsumptive recreation such as wildlife viewing and photography, along with traditional consumptive activities such as hunting, have gained popularity on the National Forest System lands, including the Chugach National Forest. Increased interest in wildlife and its management has led to the establishment of wildlife advocacy organizations. Many of these organizations play an active role in wildlife management on the Forest in partnership with the State of Alaska and the Forest Service.

Legal and Administrative Framework

- The **National Forest Management Act of 1976 (NFMA)** states that forest plans must "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area."
- **Ecosystem Management** - In 1992, the Chief of the Forest Service issued a statement committing the Forest Service to the practice of ecosystem management, which is an ecological approach to managing national forests and grasslands for multiple uses.
- The **Endangered Species Act of 1973** governs protection of specified species and the ecosystems upon which they depend.
- The **Forest Service Manual (2672)** requires the Regional Forester to identify sensitive species occurring within the region.
- The **Forest Service Manual (2672.4)** requires that a biological evaluation (BE) be prepared for all Forest Service activities to address impacts to Forest Service sensitive species.
- **36 CFR 219.27(g)** states that management prescriptions, where appropriate and to the extent practicable, shall preserve and enhance the diversity of plant and animal communities.

- **36 CFR 219.19** requires the Forest Service to identify and prevent the destruction or adverse modification of habitat determined to be critical for threatened and endangered species. It states that fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species. Viable populations are defined as those with sufficient numbers and distribution of reproductive individuals to ensure their continued existence in the planning area.

Key Indicators

- Habitat for management indicator species, species of special interest, and threatened, endangered and sensitive species
- Distribution of wildlife habitat for management indicator species, species of special interest, and threatened, endangered, and sensitive species

Resource Protection Measures

See Revised Forest Plan, Chapter 3, Forestwide Direction for wildlife and specific species.

Analysis Process

For the Chugach Forest Plan revision, the habitat needs for sustaining viable populations of individual species are addressed in two ways. First, a coarse filter assessment was used to determine the level of protection offered through the land management prescription categories. Next, the species on the Forest were reviewed to determine if any species needed further analysis because they were at risk of not maintaining viable populations due to management. These management actions and conditions needed to ensure viable populations are addressed by guidelines for specific species or species groups. This is the fine filter approach to biological conservation.

Evaluating Viability

The National Forest Management Act (NFMA) requires that the Forest Service provide for the diversity of plants and animals, based upon the suitability and capability of each national forest, as a part of meeting overall multiple-use objectives (16 USC 1604(g)(3)(B)). The NFMA implementing regulations define diversity as "the distribution and abundance of different plant and animal communities and species within the area covered by a [forest plan]" (36 CFR 219.3). In addition to providing diversity direction (36 CFR 219.26), the NFMA regulations include the following provisions for managing habitat to maintain viable populations of wildlife species:

> Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one that has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well-

> distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well-distributed so that those individuals can interact with others in the planning area. (36 CFR 219.19)

Quantitative criteria for viability (or diversity) are not specified by either the Act or the regulations. The Forest Ecosystem Management Assessment Team defined viability as “the likelihood of a species persisting well-distributed throughout its range [for] a century or longer” (FEMAT 1993). For the Chugach, the evaluation of viability includes consideration of its unique wetland complexes, Prince William Sound archipelago environment as well as current scientific thinking on population viability and conservation biology, as found in the general literature and the Chugach and Tongass-specific assessments. Further discussion follows for two key terms: "well-distributed" and "continued existence."

Well-distributed. The phrase "well-distributed in the planning area" is used in the regulations. The planning area, for the Chugach Forest Plan and for the purposes of viability analysis, includes all National Forest land within the boundaries of the Chugach. The NFMA regulations provide that habitat must be “well-distributed” so that "individuals can interact with others in the planning area." Interaction is the key operative word, because different individual species often exhibit widely different movement and dispersal capabilities. The continued existence of a population within which interaction between individuals becomes difficult (significantly less frequent) or impossible may no longer be well-distributed. The fragmentation of habitats, which isolates and creates small insular populations, contributes to decreased population distribution and increased likelihood of local extirpation (Wilcove et al. 1986). Because of the nature of our landscape and the island archipelago, relatively isolated populations may already exist with naturally higher risks to local extirpation.

In the island archipelago and naturally fragmented landscapes of Southcentral Alaska, natural interaction is often problematic, especially for species that cannot move between islands. The insular distribution patterns of several small terrestrial mammal species among individual islands illustrate these dispersal limitations. MacDonald and Cook (1999) reported that eight mammal species are endemic to the Chugach. Southcentral Alaska most likely supports ecotypes and locally adapted species on individual islands; especially the less mobile species such as small mammals, amphibians, and many invertebrates, but such relationships have not been thoroughly investigated or described. Maintaining populations across the full range of environmental conditions over which they occur retains the genetic variability that is necessary for evolution and adaptation to environmental change (Lande and Barrowclough 1987). At a broad geographic scale, environmental variability on the Chugach is classified into ecological sections that exhibit differences in climate, geology, and species distributions (see Biodiversity section). For wide-ranging species (e.g., northern goshawk, brown bear), well-distributed populations are appropriately assessed among, and within, these ecological sections across the Forest. Since the

ecological sections represent significant transitions between major ecological regions, the geographic region was used to assess the wide-ranging species. For many other species, the appropriate scale will be finer, down to small individual islands within a geographic area (e.g., Montague Island vole).

Continued Existence. Time scale is a critical component for evaluating the potential effects of Revised Forest Plan alternatives on wildlife viability. The short-term, 10- to 15-year planning period is an inadequate scale for conducting a viability analysis, which must consider long-term, cumulative changes and consequences. There are many reasons for this. The processes of evolution, speciation, and natural extinctions occur over thousands to millions of years; even when accelerated by human activity, extinction or endangerment can require many decades if not centuries (Wilson 1988). If ecosystems remain within their expected range of variability under current climatic regimes and habitats remain abundant, available, and interconnected for all species currently extant in the Forest, then it is likely that species' populations would remain at high enough levels to ensure their continued persistence into the foreseeable future. Actions taken during a planning period, in combination with past and projected future actions, may be critical in affecting a forest's ability to maintain long-term habitat viability.

Therefore, the viability analysis used a 100-year time period, or planning horizon, which is probably the minimum period over which viability can be evaluated; the scientific literature suggests 100-1,000 years (Shaffer 1981, Soule and Wilcox 1980, Shaffer 1987). Furthermore, 100 years is the average rotation age under even-aged management, and thus the time period over which old-growth stand characteristics will be significantly affected. Forests managed under a 100-year rotation will continue to cycle through the stem exclusion phases of stand development, the least favorable phase for old-growth associated species and a permanent change in forest structure (see Biodiversity section for a fuller discussion). Such changes in forest stand structure and wildlife habitat capability require a commensurate period of time over which to assess the cumulative effects to viability. In the analysis, short-term changes must be accounted for to ensure that ephemeral stages of vegetation development, such as early seral stands, upon which some wildlife species depend are not lost at any stage during the long-term changes in forest structure. Thus, the analysis is not just a look at the forest condition at two points in time separated by a century, but a consideration of all the potential short-term effects that accumulate over the decades and result in the eventual expected forest structure. For wildlife habitats to remain viable over the entire planning period, habitats must not change beyond that expected under the normal range of variability under current climatic conditions during any period within the planning period. As discussed in the Biodiversity section earlier, the conservation of biodiversity requires both a "fine" and "coarse" filter approach. All species not individually addressed under Species Assessments are addressed through a "coarse" filter or ecosystem approach. For example, the marten need not receive the fine filter approach because its primary prey and other habitat requirements are fully protected by

the retention of the Chugach National Forest within the expected range of variability under current climatic conditions.

Coarse Filter Assessment

All vertebrate species were initially assessed by the coarse filter of the ecosystem concept. If the functional habitats and systems upon which a species depends are maintained across the Forest in a connected whole, then the species that depend on those systems will have their habitat needs met. The application of this concept ensures that viable habitats are available for most species on the Forest (see Biodiversity section and Appendix B). Initial analyses suggested that not all habitat needs for some species could be met by the coarse filter approach. These species and a few selected others were further assessed by the fine filter approach.

Species were selected for detailed habitat viability assessment based on 12 criteria:

1. Seasonal occurrence in Southcentral Alaska.
2. Geographic distribution within Southcentral Alaska.
3. Geographic distribution outside of Southcentral Alaska.
4. Estimated size of the population in Southcentral Alaska.
5. Population trend throughout the species' range.
6. Population trend of the species in Southcentral Alaska.
7. Vulnerability of habitats in Southcentral Alaska to modification as a result of land management activities currently implemented or proposed for implementation.
8. Vulnerability of the species to road construction and increased access.
9. Capability of the species to disperse.
10. Average number of young produced per breeding episode.
11. Minimum age of first reproduction (in females).
12. Knowledge about the species in Southcentral Alaska.

Species were ranked by level of concern from low to high, and those species that ranked high received a fine scale habitat viability assessment (Suring and Murphy 1998).

Fine Filter Assessment

Some species have narrow ecological amplitude, are dependent upon small-scale habitat features, or their viability may be at risk from non-habitat factors such as human disturbance. The viability of these species in not assured by an ecosystem level coarse filter, but must be assessed individually to determine risks to their viability. These species requiring this fine filter approach are listed as management indicator species and species of special interest, Forest Service sensitive species requiring a Biological Evaluation, or threatened or endangered

Species requiring a Biological Assessment and Section 7 consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service as mandated by the Endangered Species Act. The Biological Assessment (BA), along with documentation of correspondence related to the BA, is found in Appendix G of the FEIS.

Management indicator species (MIS) are chosen for fine filter analyses because their habitat requirements, both specific and general, serve to indicate the outcome of management options implemented for many species with similar habitat requirements. For example, mountain goat habitat is similar enough to Dall sheep habitat that analyses for mountain goat are indicative of the effects of each Alternative upon Dall sheep habitat. Additionally, standards and guidelines developed for the conservation of seasonally important areas of goat habitat are equally applicable to Dall sheep and have been specifically linked to sheep habitat (USDA Forest Service 2000b).

Should monitoring or new information indicate MIS or their habitats change beyond that expected, those changes will indicate a need for management changes that may not have been anticipated: i.e., adaptive management.

Species of special interest (SSI) are chosen either because their habitat requirements are narrow enough that they may not be fully covered under a coarse filter approach, or because interest in them by the public or by land managers is best treated by highlighting them separately from other species. For example, Sitka black-tailed deer population viability could be assured in most areas of the Chugach National Forest by the coarse filter approach, but public interest in the species is best served by a more detailed evaluation of the effects of each alternative on the populations. To the contrary, bald eagles have specific nesting sites to which they return year after year, and such sites might not be adequately protected under a more general, coarse filter approach.

Forest Service sensitive species receive a fine filter analyses because experience on the Chugach National Forest or elsewhere within the Alaska Region of the National Forest System has shown that not all their habitat needs can be protected adequately under the coarse filter approach. Hence, their inclusion in the fine filter analyses is mandated by Alaska Region Forest Service directives.

Threatened and endangered species (TES) are included within the fine filter analyses for both legal and regulatory reasons, and because their very inclusion on the TES list is because their population viability is at risk.

As part of the fine filter analysis, protective measures designed to protect habitat for these species were developed and evaluated. Those protective measures that are likely to prove efficacious will be incorporated into Forestwide and Project-specific standards and guidelines (USDA Forest Service 2000b). The standards and guidelines providing such protective measures will prevent sensitive species and TES habitat from declining or being otherwise adversely affected.

Typically, habitat suitability index (HSI) models would be used to estimate existing and future habitat capability for each MIS. Habitat suitability models for the MIS have been developed for black oystercatchers, Kenai brown bear, moose, and mountain goats. No model has been developed for dusky Canada goose. Modeling of habitat suitability can produce misleading results without consideration for random environmental events such as spruce bark beetle epidemics and tectonic uplifts. Another limitation of HSI modeling is a requirement for a vegetation classification that is available for the entire area of interest. Differences in vegetation classification schemes make it difficult to compare model results. For this analysis, the moose HSI model was used to represent likely outcomes regarding habitat suitability between alternatives. The moose HSI model is not appropriate for population viability and is not used in that regard.

Habitat Viability Analysis

The viability analysis followed the general outline of panels used for the viability analysis on the Tongass National Forest. Each species was considered using the available information about habitat requirements, the direct, indirect and cumulative effects of management actions or activities on the habitat for each species.

Table 3-45 lists the management indicator species (MIS), threatened, endangered, and sensitive species (TES) and species of special interest (SSI) to be addressed in this analysis. The Forest Supervisor decided to use the following management indicator species: black oystercatcher, brown bear, dusky Canada goose, mountain goat and moose. These MIS were selected because their population changes are believed to indicate the effects of management activities.

Potential effects on the following species of special interest will also be discussed: gray wolf, lynx, Montague Island hoary marmot, Montague Island tundra vole, Sitka black-tailed deer, river otter, Townsend's warbler, wolverine, bald eagle, and osprey. Information on river otter habitats and populations has been included at the request of the Alaska Department of Fish and Game (ADF&G). Townsend's warblers are included, at the request of the USF&WS, as a focal species for old-growth habitats and land birds in general. Lynx and marbled murrelets are considered because there are reduced populations in much of their range in the lower 48 states. Sitka black-tailed deer are considered to be of special interest because of their extensive use for sport and subsistence hunting. Bald eagle is of interest because of its recent removal from the list of threatened and endangered species, and its status as the national symbol. Osprey is a species of special interest because it is naturally rare in Southcentral Alaska, which may be the northern periphery of the species' range.

Minimally Disturbed Areas

Of the more than 5.45 million acres of the Chugach National Forest, about 5.43 million acres (99 percent) are inventoried as roadless. Under any of the alternatives, the total percentage of the Forest that would be affected by any of the potential management activities would affect a minimum of the Forestwide wildlife habitat (from 0 to 4 percent of the roadless acres). Thus, the majority of the Chugach National Forest is effectively a conservation reserve where natural forces and non-industrial human use are the predominant disturbance factors.

Habitat viability analyses therefore were concentrated in those few areas that contained areas of specialized habitat or where the few management activities were planned. For example, moose habitats were evaluated primarily on the portion of the Kenai Peninsula managed by the Chugach National Forest because, unlike the Kenai where prescribed fire and other vegetation manipulation is planned, the rest of the Forest will be left subject to natural disturbance regimes to create or maintain existing moose habitat. Similarly, Sitka black-tailed deer habitats were more closely evaluated on Montague Island where Sitka black-tailed deer habitat would be most affected by potential actions. The areas where habitat viability evaluations were concentrated are identified under the Affected Environment for each species.

Table 3-45: Management indicator species (MIS), threatened and endangered species and sensitive species (TES/SS), and species of special interest (SSI) on the Chugach National Forest.

SPECIES	MIS	TES/SS	SSI
Brown Bear	X		
Black Oystercatcher	X		
Dusky Canada Goose	X	X	
Moose	X		
Mountain Goat	X		
Gray Wolf			X
Lynx			X
Marbled Murrelet			X
Montague Island Hoary Marmot			X
River Otter			X
Sitka Black-tailed Deer			X
Townsend's Warbler			X
Wolverine			X
Bald Eagle			X
Humpbacked Whale		X	
Montague Island Tundra Vole		X	
Northern Goshawk			X
Osprey			X
Peale's Peregrine Falcon		X	
Steller Sea Lion		X	
Trumpeter Swan		X	
Steller's Eider		X	

Affected Environment

Introduction

The Chugach National Forest in Southcentral Alaska provides a wide diversity of habitats that support over 232 vertebrate species, including approximately 51 mammals, 179 birds, and 2 amphibians. This represents 15 orders and 37 families of birds, and 6 orders and 13 families of mammals that occur on the Forest. The range of one subspecies (i.e., Kenai song sparrow) is restricted primarily to the Chugach National Forest. These species contribute to the overall health of the Forest as well as provide Forest users and visitors with a full range of opportunities that include consumptive and non-consumptive activities. In the last century, five species have been introduced (or possibly reintroduced) to the Forest, and one species has not been documented since the turn of the century (Burris and McKnight 1973, Lance 1999a).

In general, the Chugach has the same or more species present as were here during the late 1800s. The medium and large carnivores, including the brown bear, lynx, wolverine, and wolf are all here in healthy populations. Currently big game populations are at, or exceed, State of Alaska objectives over much of the Forest. Cooperative efforts have resulted in species, such as moose, being introduced. A small population of moose introduced on the Copper River Delta in 1956 has grown to about 1,300 animals (Crowley 1999). Sitka black-tailed deer, introduced to Hinchinbrook and Hawkins Islands, have increased and spread throughout Prince William Sound islands and the mainland (ADF&G 1985). The Copper River Delta is a unit of the western shorebird reserve network (USDA Forest Service 1989a).

Federal planning regulations require the use of management indicator species (MIS) for use in the Forest Plan revision process.

The management indicator species are used to: direct Forest Plan implementation, inventory, and monitoring activities; meet legal and policy requirements; set objectives for maintenance and improvement of habitat for the MIS in the alternatives; and quantify the amount and quality of habitats and population trends in each planning alternative.

In the selection of MIS, the following categories are represented where appropriate: endangered and threatened plant and animal species identified on state and federal lists for the planning area; species with special habitat needs that may be influenced significantly by planned management programs; species commonly hunted, fished, or trapped; non-game species of special interest; and additional plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.

Table 3-46 shows the number and percent of the species on the Forest using the General Habitat Types. While the greatest number of species use forested habitats, all habitat types on the Forest are important.

Table 3-46: Number and percent of species using the general habitat types.

General Habitat Types	Percent of Forest	Number of Species	Percent of Species
Forested	34.30	137	59.31
Scrub	32.80	119	51.52
Herb-Gram-Moss-Lichen	21.80	120	51.95
Sparsely Vegetated	17.04	46	19.91
Tidal Estuarine	1.62	86	37.23
Freshwater	18.39	121	52.38
Alpine	33.16	64	27.71
Riparian	27.03	96	41.56
Rocky Coast	2.59	33	14.29
Beach Assoc	13.23	75	32.47
Sheltered Inshore Waters	5.6	47	20.35

Table 3-47 shows the relative importance of the General Habitat Types to the Management Indicator Species, Threatened, Endangered, and Sensitive Species, and the Species of Special Interest.

Table 3-47: Relative importance of the general habitat types to management indicator species and species of interest.

	GENERAL HABITAT TYPES										
	Forested	Scrub	Herb-Gram-Moss-Lich	Sparsely Vegetated	Tidal Estuarine	Freshwater	Alpine	Riparian	Rocky Coast	Beach Assoc.	Sheltered Inshore Waters
Black Oystercatcher					Hi				Hi	Hi	Mod
Brown Bear	Mod	Mod	Mod	Mod	Mod	Mod	Mod	Hi		Mod	
Dusky Canada Goose		Mod	Mod		Hi	Mod		Mod		Mod	
Moose	Hi	Hi	Mod			Mod		Hi			
Mountain Goat	Hi		Mod	Mod			Hi				
Gray Wolf	Mod	Mod	Mod			Mod	Mod	Hi			
Lynx	Hi					Mod	Mod				
Marbled Murrelet	Hi			Low						Mod	Hi
Montague Is. Hoary Marmot	Mod	Mod	Hi	Mod			Hi				
River Otter	Mod	Mod	Mod		Hi	Hi		Hi	Hi	Hi	
Sitka Black-tailed Deer	Hi	Mod	Mod				Hi	Mod		Mod	
Townsend's Warbler	Hi	Mod						Hi			
Wolverine	Mod	Low	Low	Mod	Low	Hi	Mod	Hi		Mod	
Bald Eagle	Hi		Mod		Hi	Mod		Hi	Mod	Mod	
Montague Is. Tundra Vole	Mod	Mod	Mod			Mod	Mod	Mod		Hi	
Northern Goshawk	Hi	Low				Low		Low			
Osprey	Mod				Hi	Mod		Hi			
Peale's Peregrine Falcon				Low	Hi	Hi	Mod			Mod	
Steller Sea Lion					Mod				Hi	Hi	Mod
Trumpeter Swan					Hi	Hi					

Low = habitat rarely or potentially used; Mod = habitat used for feeding, refuge, or as secondary breeding habitat; Hi = habitat REQUIRED for feeding, refuge, and/or breeding.
Wolverine (*Gulo gulo katschemakensis*).

Management Indicator Species

Table 3-48 shows the amount of habitat available for each of the management indicator species on the Forest lands by Geographic Area.

Table 3-48: Acres of habitat for management indicator species by geographic area.

	Copper River Delta	Kenai Peninsula	Prince William Sound
Black Oystercatcher			21,500
Brown Bear	681,120	538,660	610,360
Dusky Canada Goose	541,750		26,980
Moose	257,690	488,890	*
Mountain Goat	86,010	841,240	409,300

Source: Chugach National Forest GIS corporate database using Land Cover Classes and species matrix. Values include only National Forest lands.
Habitat for MIS was described using the Land Cover Classes/ Species matrix database.
*Habitat for moose in Prince William Sound was not evaluated, as it is not expected to vary by alternative.

Black Oystercatcher

The black oystercatcher is one of the most abundant species of shorebirds in the Prince William Sound-Gulf of Alaska region (DeGange and Sanger 1986). The black oystercatchers are dependent on marine shorelines for their life requirements and are most abundant along low-sloping gravel or rocky shorelines (Andres 1998). The entire world population is estimated at about 11,000 individuals. More than 50 percent of that population occurs in Alaska and about 1,500-2,000 individuals reside in south coastal Alaska (Andres and Falxa 1995). Population trends for oystercatchers throughout their range are unknown, however, within in Prince William Sound, the populations are recovering from the effects of the *Exxon Valdez* oil spill in 1989 (Murphy et al. 1999).

Breeding habitat of black oystercatchers ranges from mixed sand and gravel beaches to exposed rocky headlands (Andres and Falxa 1995). Oystercatchers avoid vegetated habitats and are most abundant on non-forest islands (Webster 1941, Andres and Falxa 1995).

Continual disturbance from human activities is the greatest threat to breeding black oystercatchers. Disturbance often prevents pairs from nesting or causes them to abandon their nest sites (Andres 1998).

Forest management actions may influence the amount of human induced disturbance to oystercatchers based on different types of upland activities. This type of management may be increasingly important as human activity in Prince William Sound increases as a result of the new road to Whittier. Protection of areas with exceptionally high nesting densities of Prince William Sound, will be important to maintain current population levels (Poe and Murphy 1999).

Brown Bear

Brown bears are present throughout the Chugach National Forest on the mainland and on the major islands (Montague, Hinchinbrook and Hawkins) in Prince William Sound. Brown bear use a wide variety of habitats from sea level to alpine. Bears on the Kenai Peninsula are of most concern. This small population may be isolated on the Kenai Peninsula, and is subject to significant human impacts (Suring et al. 1998). The Kenai Peninsula brown bear has been listed by the State of Alaska as a population of special concern. An Interagency Brown Bear Study Team developed a conservation assessment on the status of the population of brown bears on the Kenai Peninsula. Specific elements of this assessment have been incorporated in the Revised Forest Plan and FEIS. The overall trend for the Kenai Peninsula brown bear is considered to be stable, however, actual population numbers are not available (ADF&G 1999c). Management agencies estimate the population to be around 280, ranging from 120 to 420 (Miller 1993).

Whether genetic isolation of the Kenai Peninsula population of brown bears has occurred is unknown (Shields 1998, in Interagency Brown Bear Study Team 1999). It is speculated that brown bear access to the mainland from the Kenai Peninsula is restricted by the narrow land gap between the Turnagain Arm of Cook Inlet and Prince William Sound; however, no work has been done to determine whether the physical or genetic isolation of the Kenai population exists in fact (Suring et al. 1998).

Brown bears are opportunistic wide-ranging foragers, so brown bear habitat may be anywhere a bear wants to be, but they do have seasonal habitat preferences. On the Kenai Peninsula immediately after emergence from the den, brown bears depend on forbs, horsetails, and graminoids, which are found in moist sites, often at low elevations. Ungulates may also form a large portion of the initial spring diet either as carrion or from direct predation, so brown bears also use the winter ranges of moose, Dall sheep, and other species as spring foraging habitat. Summer and autumn habitat for brown bears on the Kenai Peninsula is provided by streams that support spawning salmon. As autumn progresses, berries become a larger part of the brown bear diet and brown bears may move between berry patches, often at higher elevation, and the lower elevation salmon spawning streams (Suring et al. 1998).

Human activities, such as logging, mineral and energy development, water impoundments, recreational development, development of private lands, and hunting, have led to an increased likelihood of human-bear conflicts (Suring et al. 1998).

Brown bears have not been identified as a species requiring minimum patch sizes of a particular habitat type. They are not known to have specific vegetation corridor requirements, as they travel and disperse through a variety of terrain and vegetative conditions.

Southeast Alaskan brown bears are highly selective for the narrow, forested riparian zone during mid to late summer. They concentrate on specific segments

of streams where they catch spawning salmon. The forested riparian habitat associated with these salmon spawning streams provides security and resting habitats for brown bears. Maintaining riparian habitat and no-cut buffers are important for the long-term conservation of high-density brown bear populations (Titus and Beier 1999).

Increases in human activity in an area may result in increased direct human-induced deaths of bears.

Dusky Canada Goose

The dusky Canada goose is a medium-sized, dark-plumaged subspecies that nests in the Copper River Delta region of Southcentral Alaska, migrates along the Pacific Coast, and winters in southwestern Washington and Western Oregon. Originally thought to include geese breeding and coastal regions of Southeast Alaska and northern British Columbia, it is now recognized to be unique to a small part of the Gulf of Alaska (Bromley and Rothe 1999).

Monitoring of the population trend for this species for the past two decades indicates the population has declined both on wintering grounds and breeding grounds (Bromley and Rothe 1999). While the population has declined, the current population levels are similar to those in the 1950s, prior to the earthquake. Population trends, moreover, have remained stable for the last decade, suggesting that duskys are adapting to the habitat changes that resulted from the 1964 earthquake.

The Copper River Delta, the summer habitat of the geese, is a highly dynamic region continually influenced by tectonic, glacial, riverine, and tidal forces. Dusky geese were highly productive in the 1950s through the 1970s, and the population was thought limited by hunting mortality, primarily on the wintering grounds. There was minor loss of eggs to inundation by high spring tides, and similarly low rates of loss of adults, eggs, and young to predators. Indeed, numbers of geese responded quickly and positively to restrictive hunting regulations, and to the establishment of refuges on their wintering grounds during the mid-1960s. However, in 1964 an earthquake caused an uplift of the nesting grounds on the Copper River Delta, causing accelerated natural succession of marsh habitat. Earthquakes and uplift in the Copper River Delta have occurred at least four times in the past with return intervals of 600-900 years. Dusky Canada geese have apparently survived and persisted in spite of these stochastic events. Dusky Canada goose populations are expected to fluctuate within a range of natural variability. Although breeding success remained high during the first 12-15 years post-earthquake, substantial changes in nesting and brood-rearing habitat began to occur (Bromley and Rothe 1999).

Weathering of the newly uplifted marsh has increased succession with marsh plants being replaced by willows, alder, and sweet gale, and even more recently spruce and cottonwoods have become well established (Bromley and Rothe 1999).

Associated with changes in plant ecology on the Copper River Delta were associated faunal changes. In particular, brown bears and coyotes were found

more frequently on the nesting and brood-rearing areas and in greater numbers than previously and were much more active predators on the geese and their eggs. As succession progressed, predators varied in species, number, and effect on duskys (Bromley and Rothe 1999). Current research on predators of eggs, adults and goslings indicates that bald eagles may be deemed the most important predator on the Delta.

The population of duskys is now limited by factors associated with the earthquake and accelerated succession on the breeding grounds, primarily depredation of eggs, young, and adults. Significant management efforts on the breeding grounds have included the experimental testing, and now operational establishment and maintenance, of artificial nesting islands on the Copper River Delta. Duskys have consistently had much higher nest success on the structures than on the natural sites (Bromley and Rothe 1999).

In the short-term, accelerated succession is expected to continue on the Copper River Delta, and productivity of geese will likely remain low due to heavy predator activity. New marsh habitat will slowly develop on newly exposed tidal areas, but it won't be significant in influencing the status of the population. The artificial nesting program will likely continue, and while it is considered to be an important aide to gosling production, the degree to which goslings and nesting adult mortality negates or enhances production is unknown. As a result, continued monitoring is required (Bromley and Rothe 1999).

Moose

Moose are native to the Kenai Peninsula; they are also native to the Nellie Juan River valley area of Prince William Sound, and near Kings River, and in small populations on Hawkins and Hinchinbrook islands (Nowlin 1996). Moose were introduced in the Copper River Delta between 1949 and 1958, where they have become well established.

The current moose population for Copper River Delta is estimated to be approximately 1,300 animals (Crowley 1999). The population on the entire Kenai Peninsula is approximately 7,000 – 9,000 moose, of which about 1,000 of these are on the Chugach National Forest portion of the Kenai (Spraker personal communication). Moose populations on the overall Chugach National Forest currently appear to be stable (USDA Forest Service 1999c).

Moose habitat in Southcentral Alaska is associated primarily with riparian and post-glacial early-successional vegetation types. In most areas, much of the moose habitat is declining as a result of natural plant succession. Succession in some areas is transforming deciduous vegetation types (cottonwood, willow, etc.) into conifer stands. In other areas, climax deciduous vegetation is growing to sizes less valuable as moose browse (Lottsfeldt-Frost 2000).

On the Kenai Peninsula the factor limiting the growth of moose populations is the availability of early- to mid-successional habitat, and the main mortality factors are predation, hunting, and mortality from collisions with vehicles along the highway and railroad (Lottsfeldt-Frost 2000). Clearcut logging in some Kenai Peninsula conifer stands has returned vegetation to earlier successional stages

that may enhance or provide forage for moose, but the advantages of the temporarily increased forage may be offset by the longer period of reduced forage in the regenerating second-growth conifer forest. Most early- to mid-successional foraging habitat is largely a result of wildfires (Lottsfeldt-Frost 2000). Extensive spruce bark beetle outbreaks on the Kenai Peninsula (see Table 3-30a) are likely to increase the number and size of wildfires and concomitant production of moose foraging habitat. Such fires cannot be predicted nor can their extent be anticipated, so the production of acceptable foraging habitat to replace that lost through forest succession is a matter of happenstance. Hunting related mortality is controlled by the manipulation of hunting seasons, but other forms of mortality are no more predictable than are wildfire events. Accordingly, in the absence of directed habitat management, moose numbers may fluctuate unpredictably.

On the Copper River Delta, habitat conditions are expected to decline as successional changes cause mixed willow habitat types to mature, stagnate, and convert to alder, cottonwood, and conifer types. Mechanical treatments to alder/willow community types have been used to enhance moose habitat on the Copper River Delta (Lottsfeldt-Frost 2000). MacCracken and others (1997) found that the population on the west Delta was well below carrying capacity and could be increased. The greatest limiting factor for moose in this area is from hunting (Lottsfeldt-Frost 2000).

Mountain Goat

Mountain goats represent species using cliffs, alpine and subalpine, and old-growth forest habitats. Hunted populations may be sensitive to overharvest and human disturbance. The quantity and quality of winter habitat is the most limiting factor for mountain goats in Southcentral Alaska. Old-growth trees with large dense crowns have the highest value because they intercept the most snow and provide understory forage plants near the marine influence (Suring et al. 1992). Lack of snow interception in early successional stages, and lack of forage in middle successional stages, reduces their value as habitat. Further inland, mountain goat winter habitat is found on windswept rocky alpine ridges and south facing cliffs where vegetation free of snow is available.

They are also sensitive to low-level aircraft flights over summer alpine kidding habitats and wintering areas.

Current Forest Plan (1984) monitoring and aerial surveys indicate a stable to slightly increasing population surrounding the Copper River Delta and Prince William Sound and a slightly increasing population on the Kenai Peninsula (Crowley 1999). There are about 900 found on the Copper River Delta, 2,400 in Prince William Sound, and 4,500-5,800 on the Kenai Peninsula.

Species of Special Interest

Gray Wolf

The gray wolf inhabits the Kenai Peninsula, the mainland in Prince William Sound, and the Copper River Delta. Wolves require an adequate prey base of ungulates, beaver, and salmon. In most areas of Southcentral Alaska the gray wolf depends heavily on large ungulates such as moose, deer, caribou, mountain goats, and Dall sheep. Suitable habitats for wolves equate to areas capable of supporting this prey base. Wolves use a wide variety of habitats when prey are present, and can affect prey populations in those areas.

Due to social interactions, wolf densities do not exceed certain levels even when prey abundance is high. Densities of 0.1 adult wolves per square mile are considered high, and this density is often considered a saturation point beyond which wolf populations would not expand. Wolves have large home ranges (about 100 square miles per pack), use a wide variety of habitats, and are very mobile. They do not have specific vegetation corridor requirements, as they travel and disperse through a variety of terrain, vegetative conditions, and among islands separated by relatively narrow bodies of water (i.e., at least hundreds of yards) (Gasaway et al. 1983).

Wolves are legally hunted and trapped in Southcentral Alaska. Increased roaded access and increased human activity likely increase wolf deaths, both from legal and illegal hunting and trapping. Road management and increased regulation of legal harvests are seen as steps needed to reverse short-term population declines (Carnes et al. 1996).

Suring and Murphy (1998) examined the probable viability of 269 wildlife species and endemic subspecies in Southcentral Alaska. Their work suggested that wolf populations in the Chugach National Forest were secure, but the relatively isolated subpopulation of the gray wolf in the Copper River Delta was potentially at risk from management actions. Accordingly, only this small population was further evaluated. To maintain the small population in the Copper River Delta, reduction in wolf harvest may be necessary along road corridors (Carnes et al. 1996).

Lynx

Lynx are irregularly distributed throughout the Kenai Peninsula, the mainland of Prince William Sound, and on the Copper River Delta. Current lynx populations are believed to be below historical high levels. Lynx populations tend to follow cycles in the populations of snowshoe hare but typically lag behind those levels (Magoun and Johnson 1991).

Lynx use a variety of habitats, including spruce and hardwood forests, in early successional communities. The best lynx habitat in Alaska occurs where fires or other factors create and maintain a mixture of vegetation types with an abundance of early successional growth (Berrie and Stephenson 1994). This provides the best habitat for snowshoe hare and other small prey of lynx. The distribution and abundance of lynx appears to be tied to that of the snowshoe hare. Hares seek dense conifer thickets to feed on woody seedlings and

saplings and to escape predators and extreme cold; lynx frequent these habitats in search of prey (Koehler and Aubrey 1994). The lynx population on the Kenai Peninsula occurs within successional forest and alder dominated subalpine slopes.

Wildfire, an important factor in the dynamics of the northern boreal forest ecosystem (Viereck et al. 1992), is a major habitat modifier. Paragi and others (1997) suggest that optimal habitat for hare and lynx can be achieved in interior Alaska by frequent and numerous but relatively small fires, or large patchy fires with abundant unburned inclusions. However, the effects of spatial heterogeneity and juxtaposition of habitats on behavior and population dynamics of lynx are unstudied (Mowat et al. 1999).

Roads constructed for forest management, mining, or recreational purposes may increase the vulnerability of lynx to hunters and trappers (Koehler and Aubrey 1994). Lynx are legally trapped in all game management units.

Marbled Murrelet

The marbled murrelet is seabird that feeds below the water's surface on small fish and invertebrates, and is usually found within five miles of shore. Marbled murrelets nest on land, and lay only one egg. Unlike most other species in the family Alcidae, they do not nest in colonies, although at some sites they may nest in small aggregations. Except for the fall period when they are molting, flightless, and stay on the ocean, murrelets are known to fly to tree stands throughout the year.

Throughout much of its range in the Pacific Northwest, British Columbia, and Alaska, the marbled murrelet nests in large, mature coniferous trees within stands of structurally complex, coastal old-growth forest. Marbled murrelet-nesting habitat relationships are poorly understood in Southeast Alaska. Data from forested areas elsewhere within their range indicate that high volume stands of old-growth conifer forests in relatively close proximity to the coast are essential nesting habitat.

Recent surveys suggest that marbled murrelets are numerous and widespread throughout the coastal waters of Alaska, with estimates of 100,000 occurring in Prince William Sound (Kuletz 1997). Population trends within the Chugach National Forest are generally downward for the long-term, with a 67 percent decline since surveys were done in 1972 and 1973, but have been stable since 1990 (Kuletz 1997). Possible causes of estimated overall Alaska declines are oil spills, mortality from gill netting, cyclic changes in marine food productivity, and the harvesting of productive old-growth forests (which are likely their primary nesting habitat). The murrelet population was injured by the *Exxon Valdez* oil spill, when 12,800 to 14,800 were killed. The population in the oil spill area is considered to be recovering (*Exxon Valdez* Oil Spill Trustee Council 2000).

The listing of this species as threatened in Washington, Oregon, and California, and the reductions in habitat from timber harvesting, have raised concerns for the viability of this species in Southeast Alaska. An interagency conservation assessment (DeGange 1996) was conducted to synthesize literature and data

from Southeast Alaska to describe the natural history, habitat relationships and conservation status of the marbled murrelet. The assessment noted the uncertainties over how best to maintain habitat for viable, well-distributed populations of marbled murrelets in Southeast Alaska. Conceptually, uneven-aged silvicultural practices or extended harvest rotations may maintain sufficient forest structure to support nesting murrelets. However, given the uncertainties, the assessment concluded that a murrelet conservation strategy should consider a reserve-based approach, especially in those biogeographic provinces where substantial timber harvest has been concentrated and is projected to continue.

Montague Island Hoary Marmot

Montague Island hoary marmots were first described during the early 1900s, and have not been documented since. The endemic Montague Island hoary marmots were first reported by Heller (1910) in alpine habitat, near timberline, at Hanning and Zykoff Bays. There were no other recorded sightings of the marmot until 1978-79 when a marmot was seen along the northeastern coast on talus slopes.

Presently, the Montague Island hoary marmot is not provided any protective status. It is currently classified S2S3 by the Natural Heritage Program because they are endemic, found only on one island. Additionally, the population size and trends are unknown and there is a potential threat of habitat loss due to commercial timber harvest (Lance 1999a). Based on their limited, known distribution and questionable taxonomic status, Montague Island hoary marmots are a population of concern.

Marmots generally occupy open habitats such as alpine meadows and forest edge. Hoary marmots occur at high elevations, near timberline, on talus slopes, and alpine meadows (Lee and Funderburg 1982). Marmots feed mainly on green vegetation, especially grasses and forbs, but may also feed on fruit, grain, legumes, and occasionally insects (Nowack 1991).

Naturally occurring predators on Montague Island include raptors, brown bears, and river otters. In addition, mink were introduced to Montague Island in the early 1950s and are present today at unknown densities (Burris and McKnight 1973). Grizzly bears are known to feed on marmots, putting out great efforts digging them out of their dens (Bansfield 1974). Predation on marmots may occur in spring prior to the time of the first salmon runs. This protein source may be vital to bear survival when they arise from their dens (Lance 1999a).

Because there is no current information regarding population levels, or even persistence of this endemic population, there is some level of concern. Past road building for timber activities may have adversely affected talus slope habitats. Alpine habitats have not been affected (Lance 1999a).

River Otter

River otters are associated with coastal and fresh water aquatic environments and the immediately adjacent (within 100-500 feet) upland habitats. Their distribution is Forestwide in suitable habitats. Beach characteristics affect the availability of food and cover, and adjacent upland vegetation is also important in providing cover for otters. Old-growth forests have the highest habitat value,

providing canopy cover, large-diameter trees and snags, and burrow and den sites. Younger successional stages provide lower quality habitat.

River otters are common residents of coastal Alaska and occur throughout the Copper River Delta, Prince William Sound, and along the Kenai Peninsula. The river otters in Prince William Sound were considered a damaged resource by the 1989 *Exxon Valdez* oil spill but have been listed as recovered in 1999 (*Exxon Valdez* Oil Spill Trustee Council 2000). There is a concern that management for developed recreation within Prince William Sound may affect river otter populations.

Sitka Black-tailed Deer

Sitka black-tailed deer are indigenous to the coastal regions of Southeast Alaska and northwest British Columbia. Introduced to Hinchinbrook and Hawkins Islands in Southcentral Alaska from Sitka in 1916 with later supplemental stockings prior to 1925, Sitka black–tailed deer spread throughout Prince William Sound and peaked in population numbers by 1945 (Greise and Becker 1988). Sitka black-tailed deer have been hunted in the Prince William Sound area since 1935 and are the big game species receiving the highest sport and subsistence hunting use, not just in the Chugach National Forest, but also in the entire State of Alaska. On a statewide basis, Sitka black-tailed deer were harvested in greater numbers during the 1995-2000 regulatory years than were black bear, brown bear, elk, moose, mountain goat, Dall sheep, and musk-ox combined. The five-year trend for Sitka black-tailed deer harvest in the Prince William Sound area has been upward, with the highest harvest tending to come from Montague Island (ADF&G 2001b, 1999c). There are no estimates of Sitka black-tailed deer numbers, but population trends are tracked. Sitka black-tailed deer numbers in the Prince William Sound area are considered to be moderate to high, and show a general trend of increase, with occasional reductions caused by losses in severe winters (ADF&G 1999d).

Sitka black-tailed deer populations in Alaska are characterized by large fluctuations in population size. In winters of high snow, access to nutritional vegetation is limited and deer decline in body condition with large proportions of the deer population dying of starvation. The deer recover in number during successive winters of less severity (Reynolds 1979). Deer harvest in the Prince William Sound area is also closely tied to the severity of winter as reflected by snow depths. In years when the snow is deep, deer are pushed to lower elevations and more deer are harvest (ADF&G 1995, 1997, 1999d).

Deer forage at higher elevations, including the alpine, when snow depths are low enough to allow the availability of forage plants. Such plants include evergreen ground forbs such as goldthread, and with deeper snow, browse such as blueberry. Snow depths of greater than about two feet push the deer lower in elevation; in some winters down to the beach strand where snow accumulation is reduced or absent. Key deer winter range consists of mature conifer with enough gaps in the canopy to allow the understory shrub growth necessary for forage production - - - in other words, uneven aged climax conifer stands (many studies summarized in Shishido 1986).

Old-growth forests have the highest value during winter because they intercept snow and provide understory forage plants. Lack of snow interception in early successional stages during winters with deep snows and lack of forage in middle successional stages reduces their value as habitat.

Sitka black-tailed deer disperse through and use a variety of vegetation communities throughout the year, and no specific corridor requirements have been identified. Effects of patch size or induced forest fragmentation on deer habitat capability remain uncertain. Predation can act as a significant controlling factor on deer populations.

Townsend's Warbler

Townsend's warblers are fairly common breeding birds on the Chugach National Forest. In the fall, Townsend's warblers may depart interior Alaska by late August but they stay in Southeast Alaska until late September (Isleib and Kessel 1973). Townsend’s warblers from this area are thought to winter from Northwestern Washington to Southern California (Pogson et al. 1999).

Townsend's warblers can be found primarily in coniferous forests or mixed forests where coniferous trees comprise a predominant feature of the habitats (Bent 1953, Erskine 1977).

The highest densities of Townsend’s warblers (birds and routes) in the Alaska Breeding Survey are recorded on the eastern Kenai Peninsula (Andres personal communication). They also occurred in mixed coniferous-deciduous forests. On the Kenai Peninsula, Townsend's warblers were the most abundant breeding bird in 50- and 100-year old stands (Quinlan 1979).

Studies in Southeast Alaska suggest a preference for older conifer forest, but the relative importance of muskeg and commercial forest in Southeast remains unclear, making the assessment of the impact of logging on populations of Thompson's warblers in Southeast more complicated (Pogson et al. 1999). On the Kenai Peninsula, Quinlan (1979) reported that densities of Townsend's warblers in 30-year-old white spruce forest plots were less than half that found in 50- to 100-year-old white spruce forests.

At present little information on population trends in Canada or Alaska is available (Wright et al. 1998).

Additional information on this species' habitat requirements is needed, but the available information indicate that this species is likely sensitive to changes in the extent of mature forests that may occur due to insect infestations, fire or timber management (Collins et al. 1998, Pogson et al. 1999, Matsuoka et al. 1997).

Kenai Wolverine

Wolverines occur in small numbers throughout mainland Alaska primarily found in the remote areas of the State of Alaska. This little-known carnivore has been characterized as one of North America's most rare mammals (Banci 1994). The Kenai wolverine *(Gulo luscus katschemakensiis)* was described by Matschie in 1918 from the Kachemak Bay area of Southcentral Alaska and is known only from the Kenai Peninsula (Hall 1981).

The wolverine is an animal of montane forest, tundra, and taiga. Several factors appear to influence wolverine habitat selection at the landscape and stand levels. The distribution and density of large mammal carrion is a primary factor along with the level of human disturbance. Other habitat parameters such as escape cover from predators, availability of den sites, prey concentrations, and cover can affect daily movement and habitat use patterns (Howell 1999).

Wolverine in Idaho showed a significant preference for high elevation, rocky habitats in summer and montane conifer communities in winter. Females showed a specific preference for den sites and talus slopes, which were neither widely available nor evenly distributed across the landscape (Copeland 1996). Wolverines do not appear to avoid habitats inhabited by other predators, or areas with large openings. Thirty-four percent of wolverine relocations in Idaho were in openings that included burns and old clearcuts (Copeland 1996).

Human settlement and disturbance may have been a primary factor in the extirpation the wolverine from much other historic range (Wilson 1987). Human predation can also affect the wolverine population. Their low natural density and reproductive rate results in a reduced ability to compensate if trapping causes additive mortality (Van Zyll de Jong 1975). As a general rule, management actions that increase human access into remote areas, decrease the amount or distribution of carrion available, or disrupt sensitive areas such as denning habitat or dispersal corridors will decrease the effectiveness of wolverine habitat (Banci 1994). Conversely, management actions that improve habitat conditions for prey and carrion species have a positive affect on wolverine habitat. Wolverine in Idaho did not appear to avoid openings caused by timber harvest and fire (Copeland 1996).

A winter track survey done in 1995 in the Resurrection Pass was used to estimate wolverine density on the Kenai Peninsula (Golden 1996). Wolverine density on the Kenai Peninsula was estimated at that time to be 5.2 wolverine/1000km^2. Wolverines are commonly trapped on the Kenai Peninsula, and the harvest rate has declined only slightly since 1980. Trapping harvest on the Kenai Peninsula is probably a significant source of mortality for the population.

Three land management issues affect the long-term health and persistence of wolverine populations: a consistent and diverse source of large animal carrion, the presence of refugia from human disturbance, and an evaluation of management actions at the landscape level.

Bald Eagle

North America's bald eagle population reaches its highest density in southeast Alaska. Their nesting habitat is primarily old-growth trees along the coast and within riparian areas. Summer populations in Prince William Sound have been estimated at 5,000 individuals, including 1,800 to 2,000 pairs (ADF&G 1975, Bowman et al. 1993). The USF&WS and Forest Service maintain an interagency agreement for bald eagle habitat management in the Alaska Region, which includes standards and guidelines for regulating human disturbance within identified bald eagle use areas. A minimum 330-foot radius protective habitat management zone surrounds all identified eagle nest trees.

Northern Goshawk

The northern goshawk inhabits forested lands throughout North America, favoring dense stands of conifer or deciduous old growth for nesting habitat.

There is not much known of the distribution and abundance of goshawks on the Chugach National Forest. Within Southeast Alaska, the goshawk appears to be non-migratory, although it may occupy different, or overlapping, winter and breeding territories. Goshawks are medium-sized hawks and prey primarily on other birds (within Southeast Alaska, Steller's jay and varied thrush are common prey species).

A viability concern exists for the northern goshawk in Southeast Alaska due to its association with mature and old-growth forests and the decline in these habitats from timber harvesting. This concern was highlighted when the USF&WS received and accepted a petition to list the Queen Charlotte goshawk as endangered under the Endangered Species Act. Although the USF&WS determined that listing is not warranted at this time, they did express concern over goshawk population viability.

A conservation assessment (Iverson et al. 1997) was conducted to synthesize literature and original data from Southeast Alaska to describe the habitat relationships and conservation status of the northern goshawk.

Productive old-growth forest is an important component of goshawk habitat use patterns. Radio-marked goshawks consistently select this forest habitat type relative to availability, with 68 percent of all relocations occurring in productive old-growth forest. Most other habitat types (such as alpine, subalpine, peatland (muskeg), and clearcuts) were used infrequently or avoided by goshawks.

Timber harvesting on the Chugach (and on private lands in Southcentral Alaska) results in the conversion of old-growth forest (a selected habitat type) to young-growth forest (an avoided habitat type) and thus suggests decline in goshawk habitat capability. Iverson and others (1997) evaluated a variety of silvicultural techniques and concluded that stand structures selected by goshawks could be maintained using uneven-aged practices. Additionally, they concluded that goshawk habitat theoretically could be maintained across the landscape under a 300-year rotation.

Threatened, Endangered and Sensitive Species

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service under authority of the Endangered Species Act of 1973, as amended. An endangered species is defined as one that is "in danger of extinction throughout all or a significant portion of its range." A threatened species is defined as one "that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range . . ." [FSM 2670.5 (81) and FSM 2670.5 (211), respectively]. A proposed species is defined as one for which "information now in possession of the USF&WS indicates that proposing to list the species as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threats are not currently available to support proposed rules" (FSM 2670.5). The Federally listed species within the boundaries of the Chugach National Forest are (National Marine Fisheries Service 1990):

Endangered Species

- Humpback whales (*Megaptera novaeangliae*)
- Steller (Northern) sea lion (*Eumetopias jubata*)

Threatened Species

- Steller's eider (*Polystica stelleri*)

Pursuant to Section 7 of the Endangered Species Act, a Biological Assessment was prepared to assess the effects of the Forest Plan revision on endangered or threatened species and ensure that proposed actions would not jeopardize the continued existence of listed species (Appendix G).

Based upon the analysis presented in Appendix G, activities allowed in the Revised Forest Plan would not adversely affect the humpback whale, Steller sea lion, Steller's eider or their habitats. In addition, formal and informal consultation procedures (as directed by the Endangered Species Act, as amended in 50 CFR 17.7, and Forest Service Manual 2670) are used with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service on all site-specific projects that implement the Revised Forest Plan. Forestwide standards and guidelines for threatened and endangered species also direct that all projects will comply with requirements of the Endangered Species Act and Forest Service Policy (FSM 2670).

Sensitive Species

Sensitive species are those plant and animal species identified by the Regional Forester for which population viability is a concern on national forest lands within the region. Either a significant current or predicted downward trend in population numbers or density, or a significant current or predicted downward trend in habitat capability that would reduce a species' existing distribution constitutes a viability concern. It is Forest Service policy to identify and manage sensitive species and their habitats to prevent the species from becoming threatened or endangered because of Forest Service management actions. The goal of the

Forest Service Sensitive Species Program (FSM 2670) is to ensure that species numbers and population distribution are adequate so that no federal listing will be required and no extirpation will occur on national forest lands.

The Forest Service has also entered into an interagency Memorandum of Understanding with the USF&WS and other federal agencies at the national level, and with the USF&WS and Alaska Department of Fish and Game at the regional level, to cooperate in the conservation of species tending toward federal listing so that listing is unnecessary. (See Revised Forest Plan, Appendix D)

The Alaska Region Sensitive Species List was first established in 1990, and a technical revision was completed in 1994 when 22 plants and Queen Charlotte goshawk were added. The list was revised in 1999 when four plants were removed from the list. There are 18 plants and 9 vertebrates currently designated as sensitive species within the Alaska Region. Ten plants and eight vertebrates are known or suspected to occur on the Chugach National Forest. Four vertebrate species are discussed below, two are discussed as species of special interest, and two are discussed under Management Indicator Species.

Montague Island Tundra Vole

Montague Island tundra vole were first collected from Montague Island, Prince William Sound, Alaska, and described as a new subspecies, *Microtus oeconomus elymocetes*, by Osgood in 1906 (Lance 1999b).

This subspecies is known only from Montague Island. This species is rated by the Nature Conservancy, Alaska Natural Heritage Program, as G5T2/S2, a population of highly ecological concern both at the state and national levels.

This vole occurs throughout Montague Island, and has been recorded from shoreline to alpine (Heller 1910, Lance 1999b, Lance and Cook 1995). High populations of *Microtus* are typically associated with early stages of plant succession (Rose and Birney 1985), when grasses and woody perennials dominate the plant community (Wetzel 1958). Montague Island tundra voles have most frequently been found in Beach Fringe zones, and are often found in association with riparian vegetation such as skunk cabbage (Weintraub and Cook 1992). Historically they have been reported in every vegetation type from shoreline to alpine, including forest (Heller 1910).

Currently, there are no data available on population estimates for the Montague Island tundra vole. Other populations of *Microtus* fluctuate cyclically with a roughly 3-year periodicity, and highs for one period are not necessarily similar to highs in another period. There is no reason to believe that Montague Island tundra voles do not experience large fluctuations in population numbers, and may exhibit population cycles as do other microtines. The U.S. Fish and Wildlife Service recommends further investigation of population trends prior to adopting further land use practices on Montague Island (Lance and Cook 1995).

Osprey

The best available information indicates that the osprey is naturally rare in Southcentral Alaska and this may represent the periphery of the species' range. Ospreys nest from late April through August and over winter in Mexico and Central America.

Little is known about the status of osprey populations in Alaska (Van Daele 1994). Limiting factors are unknown, but available nest sites and foraging areas do not appear to be limiting. Interaction and competition with the abundant bald eagle population may be a limiting factor.

Osprey nests are generally located in the hemlock/spruce forest type and usually near lakes, streams, beaver ponds, coastal beaches or large estuaries. Ospreys generally use broken-off snags or large green trees for nesting structures. Much of this habitat is intact on the Chugach National Forest and has not been modified through management activities. Apparently factors other than nest site habitat are affecting the distribution and abundance of osprey in Southcentral Alaska.

Osprey feed mainly on fish, but may occasionally take small mammals, birds, amphibians or small rodents (Van Daele 1994). More information about how other factors such as commercial fishing, seasonal abundance of prey species in the ocean environment, climate, and interactions between bald eagles, ravens, goshawks, and other raptors in Southcentral Alaska may affect osprey could lead to a better understanding of their limited abundance and distribution in Southcentral Alaska.

Peale's Peregrine Falcon

The Peale's peregrine falcon is a crow-sized falcon that breeds on the offshore islands along the coasts of Alaska and British Columbia.

The Peale's falcon breeds along the inner and outer coast of Prince William Sound, and along the Kenai Peninsula, mostly associated with colonies of sea birds. These birds feed on seabirds and gulls.

Common nesting habitats are ledges on tall cliffs. Nest site components for this bird include ledges, potholes, or small caves that are inaccessible to small mammalian predators and that provide protection from rain and excessive heat or cold. A source of water (river, coast, lake or marsh) is almost always close to the nest site, probably in conjunction with an adequate prey base. Other nest sites have been found on benches of rocky bluffs and abandoned nests of pelagic cormorants, bald eagles, and ravens. Peale's peregrine falcon populations are considered to be stable in Alaska (Schempf 1997).

Trumpeter Swan

Trumpeter swans are common residents of south coastal Alaska. They breed on the Kenai Peninsula and on the Copper River Delta on the Chugach National Forest. Trumpeter swans winter in ice-free areas throughout Southcentral and Southeast Alaska. Within the Forest, winter concentrations have been documented at Eyak Lake and Martin Lake near Cordova (ADF&G 1985) and other open water areas near Cordova (Islieb and Kessel 1973).

Nesting on the Chugach portion of the Kenai Peninsula portion is limited to the Portage-Twentymile drainage system, with only a few nest sites known. There is a large (hundreds) nesting population of trumpeter swans on the Copper River Delta.

The population of white swans on the Copper River Delta increased steadily between 1978 and 1985, in response to several years of good to excellent reproductive success during the early 1980s. The population leveled off in fall 1985 at 898 white swans and began a reverse trend, declining to a low of 526 swans in fall 1991. Since then, the number of swans has increased somewhat and seems to have stabilized. Reproductive success has fluctuated over the years, likely due in large part to weather conditions during the breeding season. Production in 1998 was above average (Logan 1998).

Surveys by the U.S. Fish and Wildlife Service (Logan 1998) estimated the Copper River Delta population to be about 800-900, and the five-year population trend is considered to be stable. Numerous swans from other parts of Alaska migrate through Southcentral Alaska.

Nesting areas for the trumpeter swans are limited. Only a small percentage of lakes contain a suitable blend of food and protective cover. A pair may use successful nest sites for 20 years or more. Loss of the nest or brood may result in desertion of the nesting territory (ADF&G 1985). Trumpeter swans are very sensitive to disturbances during the breeding season from such things as airplanes, boats, proximity to a road, or other human recreational activities.

Environmental Consequences

Introduction

The discussion of environmental consequences for wildlife is divided into five parts: (1) management indicator species; (2) species of special interest; and (3) threatened, endangered, and sensitive wildlife species viability; (4) general effects; and, (5) cumulative effects. Habitat capability estimates by alternative are projected for moose using a new model as discussed below. As a part of the demand for subsistence resources, deer and moose supply and demand is discussed in the community-by-community effects sections.

The purpose of this analysis is to evaluate how activities associated with Revised Forest Plan alternatives may affect the viability and distribution of wildlife species with potential conservation concerns.

Table 3-49 summarizes information regarding risks and concerns for the species of concern and presents additional information on habitat and possible approaches for maintaining populations well-distributed for those species.

These risk factors and the location where they occur on the Forest were a primary consideration in this analysis. The first step in each species assessment was to determine the risk factors for each species. Then management prescriptions were evaluated by category to determine the extent to which the species would be protected from the risk factors. Forestwide standards and guidelines were considered, as were standards and guidelines specific to each prescription when appropriate. Finally, an outcome or finding was made for each species.

Table 3-50 shows the array of management indicator species, threatened, endangered, and sensitive species, and species of special interest by general habitat type within the three geographic areas on the Chugach National Forest.

Table 3-51 summarizes the risks to species of concern by various habitat types.

Table 3-49: Some important habitat components and conservation options for selected species of concern.

Habitat Components or Considerations	Conservation Options
Black Oystercatcher Suitable Habitat. Other considerations: Dispersed or developed recreation on or near low gradient sand or gravel beaches. Effects of the Exxon Valdez oil spill.	Buffer zones with seasonal use restrictions placed around high concentrations of nesting oystercatchers. Sheltered bays that serve as winter refuge should be protected from human disturbance Source: Black Oystercatcher Assessment. Poe and Murphy 1999.
Brown Bear Productive anadromous fish habitat. Large unroaded areas with availability of summer alpine habitat. Other considerations: Road density and roaded access. Camp and community waste disposal sites.	750' buffers on moderate-gradient/mixed control and flood plain process group anadromous fish streams to provide screened foraging habitat. Manage human activity to minimize encounters and illegal kills; consider ways to concentrate human activity within landscapes. Source: Interdisciplinary Team meetings.
Dusky Canada Goose Suitable nesting habitat. Predation, both human and animal.	Continue artificial nest island program. Implement Dusky Canada goose strategy if population levels fall below. Source: Dusky Canada Assessment (Bromley and Rothe, 1999).
Copper River Gray Wolf Suitable habitat for prey species, especially moose. Other considerations: Road density and roaded access for hunting and trapping.	Maintain habitat to support ample prey populations. For moose maintain early seral conditions in winter range. Consider control of roaded access and work with ADF&G to manage illegal kills. Source: Gray Wolf Assessment. (Carnes, 1996).
Marbled Murrelet Productive old growth within 31 miles of the ocean, and at lower elevations in heads of bays. Other considerations: Gillnet mortality and other at-sea effects.	Maintain productive old growth in heads of bays, emphasizing those near aquatic or terrestrial concentration areas. Source: Marbled Murrelet Assessment. (Kuletz 1997).
Montague Island Marmot Suitable habitat. Other considerations: Road density and roaded access.	Surveys are needed to determine location and abundance of marmots on Montague Island. Source: Marmot Assessment. (Lance, 1999).
Montague Island Tundra Vole Suitable habitat. Other considerations: Road density and roaded access.	Protect beach fringes. Monitor populations on the island. Source: Vole Assessment. (Lance, 1999).
Northern Goshawk Productive old growth. Nest sites below 800 ft. elevation. Large (10,000-30,000 acres) use areas of mixed habitats.	Maintain productive old growth within large watersheds so that at least 33 percent is 100-200 years old, and 33 percent 200-300 years old. Nesting habitat (600+ acres) available in each 10,000-30,000 acre watershed. Source: Goshawk Assessment. (Iverson et al. 1997).
Wolverine Suitable habitat for prey species, especially moose. Other considerations: Road density and roaded access for hunting and trapping.	Maintain habitat to support ample prey populations. For moose maintain early seral conditions in winter range. Consider control of roaded access and work with ADF&G to manage illegal kills. Source: Wolverine assessment (Howell 1999).

Table 3-50: Management indicator species and species of interest showing general habitat types and geographic areas of concern.

	Geographic Areas of the Chugach National Forest		
General Habitat Type	**Kenai Peninsula**	**Prince William Sound**	**Copper River Delta**
Early forest succession	Moose Lynx	Moose	Dusky Canada goose Lynx Moose Trumpeter swan
Late forest succession	Townsend's warbler Marbled murrelet Northern goshawk	Bald eagle Marbled murrelet Montague Island tundra vole Northern goshawk Sitka black-tailed deer Townsend's warbler	Bald eagle Northern goshawk Townsend's warbler
Alpine	Mountain goat	Montague Island marmot Sitka Black-tailed deer	Mountain goat
Freshwater	Brown bear Wolverine	River otter	Dusky Canada goose Trumpeter swan River otter Wolf
Riparian	Bald eagle Brown bear Moose Osprey River otter Townsend's warbler Wolverine	Bald eagle Brown bear Osprey River otter Townsend's warbler	Bald eagle Brown bear Gray wolf Moose Osprey River otter Townsend's warbler
Rocky Coast		Black oystercatcher Steller sea lion	Black oystercatcher Steller sea lion
Beach Association.		Black oystercatcher River otter Montague Island tundra vole	Black oystercatcher River otter
Sheltered Inshore Waters		Marbled murrelet Steller sea lion	Marbled murrelet Steller sea lion

Table 3-51: Potential risk factors to wildlife species of conservation concern by habitat.

Potential Risks to Wildlife (from the Activity Matrix)	General habitats										
	Forested	Scrub	Herb—Gram-Moss-Lichen	Sparsely Vegetated	Tidal Estuarine	Freshwater	Alpine	Riparian	Rocky Coast	Beach Association	Sheltered Inshore Waters
FS vegetation management	X	X	X					X		X	
FS fish habitat projects					X	X		X			
Pest management	X							X			
Insect and disease outbreaks	X							X			
Invasion by exotic plants	X	X	X			X		X		X	
Prescribed fire	X	X	X								
Timber harvest	X					X		X			
Minerals activities	X	X	X	X	X	X	X	X			X
Recreational gold panning				X	X	X	X	X			X
OHV designated routes, summer	X	X	X		X	X	X	X		X	X
OHV other purposes	X	X	X	X	X	X	X	X		X	X
Nonmotorized recreation use, hiking camping	X	X	X	X	X	X	X	X	X	X	X
Day use facilities			X		X	X		X		X	
FS recreational cabins	X	X	X		X	X				X	
Campgrounds	X	X	X		X	X		X		X	X
Hardened dispersed camping	X	X	X		X	X	X	X		X	X
Marine transfer facilities									X	X	
Boat docks and ramps						X				X	
Mode changes: parking lots at trailheads, ferry terminals, etc.	X	X	X			X		X		X	X
New roads	X	X	X		X	X		X		X	X
New trails	X	X	X	X	X	X	X	X			X
Trail reconstruction	X	X	X	X	X	X	X	X			X
Electronic sites							X				X

Management Indicator Species

The management prescriptions used in each alternative fall into categories that represent a broad spectrum of impacts on the landscape. Category 1 is described as primitive and allows natural processes to occur relatively free from the influence of humans. Category 2 is semi-primitive and human influences on the ecological processes are limited. Category 3 is moderate development. Management activities may occur but natural ecological processes and patterns will normally predominate. Category 4 is resource development emphasis and allows for a variety of habitat and recreational activities and development to occur. Category 5 is long-term disturbance with human influences on the ecological processes dominating. For the purpose of evaluating relative impacts to habitat for the various species, the prescriptions found in Categories 1 and 2 (total 17) are considered low impact, the prescriptions found in Category 3 (total 6) are considered moderate impact and Category 4 and 5 prescriptions (total 4) are considered high impact.

Black Oystercatcher

Black oystercatchers are dependent upon marine shorelines for their life requirements and are most abundant along low-sloping gravel or rocky shorelines (Andres 1998). Because this habitat occurs in patches, they are distributed unevenly throughout their range. Breeding habitat of black oystercatchers ranges from mixed sand and gravel beaches to exposed rocky headlands. Oystercatchers avoid vegetated habitats and are most abundant on non-forested areas and islands.

Black oystercatchers were an injured species due to the *Exxon Valdez* oil spill. The population of black oystercatchers within Prince William Sound is considered to be recovering at this time, but has not yet met specific recovery objectives.

Human and animal disturbance of black oystercatchers during the nesting season can result in nest abandonment, and continued disturbance may preclude the use of nesting beaches (Murphy et al. 1999). Black oystercatchers can recolonized abandoned nesting beaches within 7 years of the cessation of disturbance (Andres 1998).

A GIS model was created to identify potential black oystercatcher nesting habitat in Prince William Sound (Suring no date). The model serves as the best estimate about the location and amount of potential habitat that is available to Black Oystercatchers in Prince William Sound.

Areas were identified as high, medium or low in terms of habitat suitability. These points were overlaid with a GIS coverage of recreation destination points to assess potential disturbance effects on the Black Oystercatcher. Approximately 44 percent of the suitable habitats that were ranked as high and medium value overlap with recreation destination points. The remaining 56 percent of suitable habitat occur in low use areas or outside of expected recreational use areas.

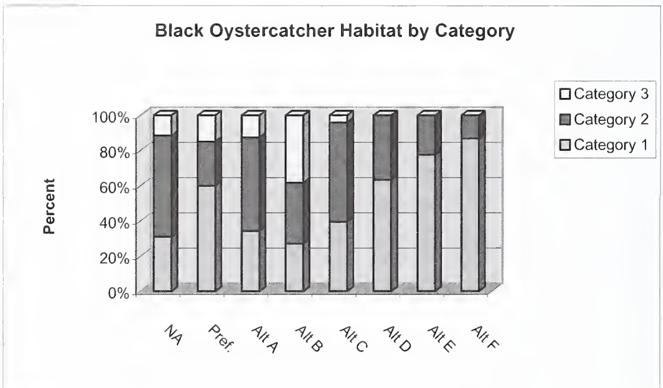
Seasonal no use restrictions and buffer zones placed around high concentration of nesting oystercatchers are believed to mitigate potential effects from dispersed recreation activities within Prince William Sound. The Seabird Rookeries and the Waterfowl and Shorebirds Habitats management guidelines will be applied to mitigate disturbances to those species as well. The Revised Forest Plan contains a guideline to provide a minimum distance buffer. Some level of disturbance is likely to occur under all alternatives.

The majority of recreational use of Prince William Sound by kayakers, boaters, and other water-borne recreationists is not within the management purview of the Forest Service, and recreational use is anticipated to increase because of improved access to Whittier. Black oystercatchers prefer sandy or gravelly beaches with a gentle gradient for nesting and these characteristics are often attractive to water-borne campers and day-users, so some disturbance to nesting black oystercatchers is inevitable but the level of disturbance is impossible to predict. More than 200 miles of beach in Prince William Sound is considered to be black oystercatcher nesting habitat, and some of that is in more remote locations such as Knight and Montague Islands that are more difficult to access

by kayakers or small boats. Disturbance to nesting black oystercatchers would be intermittent and of short duration, so total abandonment of any nesting beaches is not anticipated although individual nesting birds may be affected. In the worst case of beach abandonment, recolonization is likely in future years, so major threats to black oystercatcher population viability caused by unregulated activities in Prince William Sound are not expected. Standards and guidelines at the Forestwide level, and mitigation efforts at the project level, would limit any effects from Forest Service management or permitted activities. Accordingly, such activities are not expected to affect black oystercatcher populations or their habitat.

Figure 3-37 shows the distribution of potential black oystercatcher habitat by prescriptions category by alternative.

Figure 3-37: Distribution of potential black oystercatcher habitat on the Chugach National Forest by prescription category (21,500 acres).



Brown Bears

Brown bears are wide-ranging and use a variety of habitats. The late summer season has been identified as the most critical or limiting period for brown bear. Bears concentrate in lower elevation valley bottoms and along salmon streams during this season. This is often the season of highest human use in these areas, and the location of the most intense resource developments. Bears use a variety of habitats during this season, but the estuaries and riparian areas with anadromous fish are of the highest importance.

The literature indicates that brown bears can be also impacted by human activities in the winter (Olliff et al. 1999). There are three stages in the annual cycle where brown bears are vulnerable to the impacts of winter recreation use: (1) pre-denning, (2) denning, and (3) post-denning emergence. Conflicts could occur when snowmobile and skiing use coincides with spring bear emergence

and foraging. Research shows varying effects of human use on hibernating bears. One study in Alaska on the impact of winter sensing surveys and small fixed-wing aircraft on denning bears found none of the radio-collared bears deserted dens, and there was no evidence of mortality (Reynolds et al. 1984).

Habitat effectiveness for brown bears depends on the interactions of habitat quality, as described by vegetation, food availability, and abiotic factors and human activities. Modeling suggests that past management activities have reduced habitat effectiveness for bears, not just on the Chugach National Forest, but on a large portion of the Kenai Peninsula by more than 70 percent as a result of disturbance and mortality associated with human facilities and activities (Suring et al. 1998).

Habitat components such as availability of cover near salmon streams, availability of breeding habitats in alpine, and travel corridors were considered for this analysis. Also considered were the pattern and connections between landscapes. Human activities such as road access, mining operations, developed recreation, dispersed recreation, and waste disposal were also considered.

Forestwide standards and guidelines and a prescription specific for brown bears were developed during the planning process as tools to help maintain brown bear viability on the Chugach. The Brown Bear Core Area Management Area prescription limits human-bear interactions and prohibits Forest Service road construction and utility corridors. The standards to prevent brown bear access to food and garbage were developed during the planning process as tools to help maintain brown bear population and habitat viability on the entire Chugach National Forest, and particularly on the Kenai Peninsula portion. The entire Kenai Peninsula harbors between 250 and 300 brown bears with a total allowable take of 14 bears per year. Bear-human conflicts have increased on the Kenai Peninsula since the mid-1960s to the point where the 1995 fall hunting season was closed because of the excessive Defense of Life or Property (DLP) kill (Schwartz et al. 1999). The following Forestwide standard was developed to limit the attractiveness of garbage and food to bears and thus assist in limiting DLP take:

> Require disposal or removal of garbage from all permanent and temporary facilities, camps or sites to prevent habituation of wildlife. Require food and garbage to be stored in bear-proof containers or by methods that make it unavailable to wildlife.

Revised Forest Plan standards and guidelines were developed to provide 750-foot buffers along anadromous fish streams to provide screened foraging habitat for bears and to manage human activity to minimize encounters in all alternatives. There is a risk, albeit slight, that maintenance of vegetative cover along Class I anadromous streams would allow bears to approach undetected closer to anglers than might be the case were some vegetation was removed or altered, and thus slightly increase the chances of a bear-human conflict. Such risk to the human is outweighed by the assumption of increased benefit of

escape and hiding cover to enable bears feeding in the area to avoid other bears and humans, alike. The location of the trails is expected to result in overall reductions in human-bear conflicts.

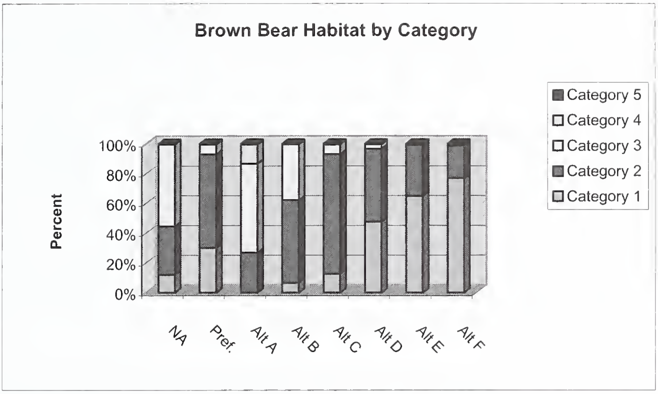
Figure 3-38 shows the distribution of potential brown bear habitat by prescription category by alternative. At the Forest scale, Alternative A would be considered to have the most potential for brown bear habitat disturbance, followed in decreasing potential by No Action, B, C, Preferred, D, E, and F.

Summer trail access in the Kenai Peninsula portion of the Chugach National Forest at the end of the first decade is projected to be slightly over 500 miles in the Preferred Alternative, although only 14 miles of that is planned for motorized use, with total summer trail access declining, in order, through Alternatives C, D, A, B, E, and No Action, to 309 miles in Alternative F (Table 3-70). The areas of the Kenai Peninsula accessible by road would remain at about current levels under all alternatives. Some campgrounds on the Kenai Peninsula currently have occupancy rates of between 80 and 100 percent on summer weekends and during salmon runs, and usage is not expected to decline.

The Brown Bear Core Area Management Area prescription sets a priority for managing to meet brown bear needs and reducing human-bear conflicts. Ranking the alternatives considering the amount of Brown Bear Core Area management prescription applied on the Kenai Peninsula, Alternative D has the most followed in descending order, Preferred, F, B, C, A, E, and No Action.

The likelihood of management activities affecting the viability of the brown bear on the Forest is low because the Forestwide standards and guidelines will be applied to help maintain the brown bear and its habitat. The largest potential impact from Forest management and permitted activities is on the Kenai Peninsula. Strategies and mitigation measures are in place to protect brown bears and their habitat, but the level of direct take of brown bears for DLP reasons cannot be predicted (USDA Forest Service 2000b). It is anticipated that any increased level of human-bear conflicts from increased access on Forest trails will be minor because the majority of DLP take of brown bears has been by residents of the Kenai Peninsula who are currently increasing in number. Should the brown bear population of the Kenai Peninsula portion of the Chugach National Forest become depleted, it would have ripple effects throughout the entire Kenai Peninsula because the brown bears traverse large areas and are often resident on lands under different management jurisdictions (Ernst personal communication). Influx of additional bears from outside the Kenai Peninsula is anticipated to be limited because of likely barriers to immigration, such as the narrow neck that connects the Kenai Peninsula to the mainland.

Figure 3-38: Distribution of potential brown bear habitat on the Chugach National Forest by prescription category (1,828,190 acres).



Dusky Canada Goose

The dusky Canada goose (duskys) is an Alaska Region sensitive species. Dusky Canada geese nest in the wetland complexes of the Copper River Delta. The area is highly dynamic and undergoing accelerated succession as a result of an earthquake and associated tectonic uplift. Habitat modeling to determine rate of succession has shown that dusky Canada goose nesting habitat will remain constant over the next 100 years and is not expected to be limiting (DeVelice 1999). Prior to the earthquake the dusky Canada geese primarily nested in the mixed grass/forb vegetation type (DeVelice 1999). The model predicted a decline in this habitat and a large increase in the shrub component over time. Since the earthquake, the geese have shifted their nesting preference and are currently nesting primarily in the new shrub areas. Nest predation has increased, but re-nesting has become more common (Campbell 1990). Secondary nest attempts are generally more successful as predators have a wider range of available alternative prey.

Risks to the dusky Canada goose would be associated with indirect effects of disturbance of nest sites, molting areas and fall concentration areas (Pacific Flyway Council 1997). In this regard, management area prescriptions that preclude such activities as nest island construction or predator control would increase the risk to viability of the dusky Canada goose.

Two Forestwide guidelines would apply to the dusky Canada goose: 1) seasonal restriction on human activities and 2) waterfowl and shorebirds habitat management.

Figure 3-39 shows the distribution of potential dusky Canada goose habitat on the Chugach National Forest by prescription category and alternative.

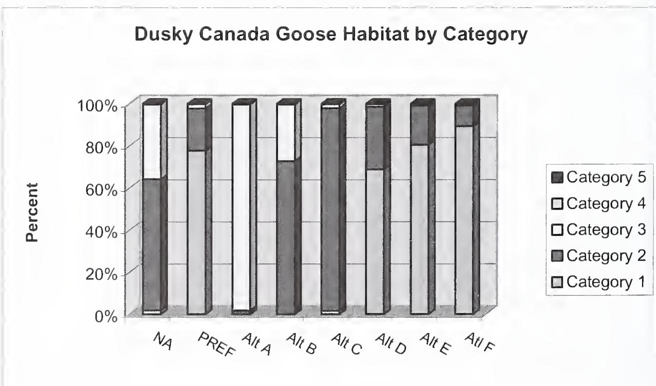
When ranked in order of decreasing amounts of risk to maintaining viable populations on the Copper River Delta, Alternative A is first followed by the No Action, B, C, Preferred, D, E, and Alternative F, in order. There is some risk associated with Alternative F, due to the factors mentioned above. Current management policy would preclude construction of artificial nesting islands for duskys in Alternative F unless the species were considered as a threatened or endangered species.

The likelihood of Forest management activities affecting the viability of the populations of the dusky Canada goose is low because the management area prescriptions applied to the Copper River Delta and the Forestwide standards and guidelines will be applied to protect nest sites.

Implementation of these standards and guidelines is expected to minimize any adverse effects on dusky Canada goose populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of viability.

Random stochastic events, such as the uplift from the 1964 earthquake, are likely to occur in the future. Other earthquakes have occurred in the past and dusky Canada goose populations have persisted in the area. Populations are expected to fluctuate in response to these events and persist over time. Risks to the dusky are lowest on the Copper River Delta under the alternatives that allow active management activities to occur. Artificial nest platforms and predator control activities would enhance nesting success in the area, and likely speed up the recovery process (Campbell 1990).

Figure 3-39: Distribution of potential dusky Canada goose habitat on the Chugach National Forest by prescription category (541,750 acres).



Moose

Natural successional processes will decrease the amount of forage available for moose in both the Kenai and Copper River Delta geographic areas. The habitat suitability models (HSI) show in both instances a decrease in the quality of habitat for moose in winter. The HIS models were based primarily upon the quality of moose winter range (Lottsfeldt-Frost 2000) because that is thought to be the primary limiting factor for moose (MacCracken et al. 1997, Suring and Sterne 1998). Predictions in changes in moose forage over time were based solely on the assumption of only gradual natural disturbances occurring. Further sudden changes such as the earthquake that transformed much of the Copper River Delta cannot be predicted, although they are possible. It is recognized that this is likely not a valid assumption over the long term. In addition to discounting sudden natural changes, the HIS models ignore anthropogenic influences on the Chugach National Forest, and thus must be considered only a baseline estimate of the potential amount of moose winter habitat. The HSI models used were developed to describe the current habitat quality and not predict actual moose numbers.

Within the prescriptions there are various management activities permitted, not permitted or allowed under certain conditions. Of these activities, wildlife habitat improvement projects, prescribed fire, commercial timber harvest and new road construction have the greatest change in the amount of moose habitat. Of the management activities with a direct effect on moose habitat that may be permitted under the different alternatives, the only one planned for the Kenai Peninsula is prescribed fire.

Categories rated as low impact (Categories 1 and 2) allow for some wildlife habitat improvement projects and prescribed fire. Mechanical cutting of older forage species is an example of an improvement project that could benefit moose. Similarly, prescribed burning is a well-established tool that creates early seral communities important to moose. Low impact categories almost exclusively do not allow timber harvest of any kind or road building.

Category 3, moderate impact, prescriptions allow for wildlife habitat improvement projects, prescribed fire, timber harvest and road construction. In all cases wildlife habitat improvement projects can occur if they are needed. Prescribed burning would be used to create moose habitat. Some commercial harvest of timber may occur and has the potential to create early successional habitats for moose. Road building, with seasonal closures in some cases, would be allowed primarily to provide access to recreational areas.

High impact prescriptions would cause the most disturbances to moose and their habitat. The emphasis in these prescriptions would be dominated by human activity. Wildlife habitat improvement projects and prescribed burning can occur in two of the four prescriptions. Timber harvest can occur in one of the four prescriptions in an active attempt to manage for the spruce bark beetle infestation. New roads can be constructed in most cases.

Figures 3-40 and 3-41 show a comparison of moose winter habitat by prescription category by alternative for the Kenai Peninsula and for the Copper River Delta. For winter moose habitat on the Kenai Peninsula geographic area low impact prescriptions (Categories 1 and 2) dominate Alternatives Preferred, C, D, E, and F. In Alternatives A, B and No Action moderate impact prescription (Category 3) dominates. High impact categories do not dominate any alternative. For winter moose habitat on the Copper River Delta geographic area, low impact categories dominate all alternatives except Alternative A. Alternative A has moderate impact categories as its theme. No high impact categories dominate any alternative for the Copper River Delta.

Figure 3-40 Percent of prescription categories on the Kenai Peninsula that may affect moose winter habitat (482,100 acres).

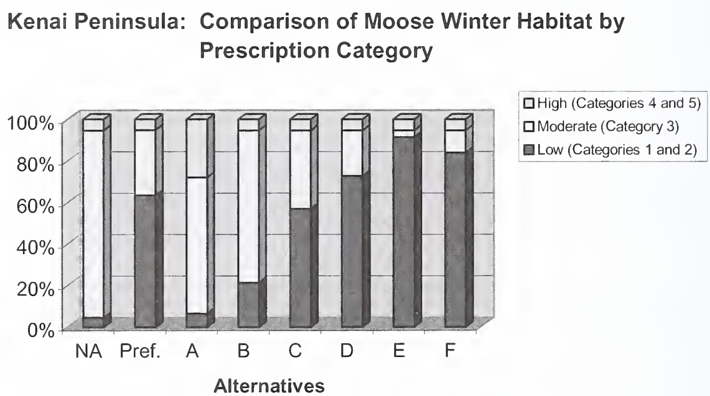
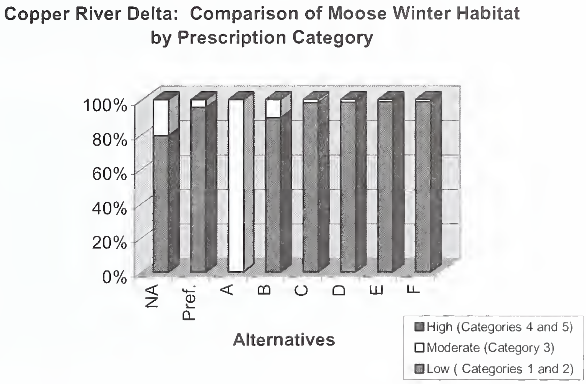


Figure 3-41 Percent of prescription categories on the Copper River Delta that may affect moose winter habitat (256,860 acres).



The only management activity planned on the Kenai Peninsula geographic area that may affect moose habitat is prescribed fire. In general, prescribed burns are planned in areas that offer no forage to moose, have a high probability of regenerating with plant species that moose prefer and are in (or near) moose winter range. The useful life of a burn for moose has been estimated at less than 50 years with moose densities peaking 20-25 years after the burn (LeResche et al. 1974). Weixelman and others (1988) found a 4-fold increase in browse production (lbs./acre) three years post burn.

Burning is planned for 3,300 acres per year in moose winter range in Alternatives Preferred, No Action, A, B, and C. Alternatives D, E and F have less acres planned for burning (average of 1,200 acres per year). The areas most likely to be burned are closed needleleaf, closed broadleaf and closed scrub/low and tall shrub. Of the approximately 100,000 acres in which prescribed fire might be used, only 0.033 percent would be deliberately burned in any year in Alternatives No Action, Preferred, A, B, and C, with only 0.012 percent burned in any year in Alternatives D, E, and F. Altering these landcover classifications to early seral plant communities by burning would slightly improve the habitat for moose over time. The most improvement would occur in Alternatives Preferred, No Action, A, B, and C with a slightly lower improvement seen in the remaining alternatives. Figures 3-42 and 3-43 show a comparison of the habitat suitability index by alternative.

The fire history of the Kenai Peninsula prior to the early 1900s is unclear, but from 1914 to 1999 about 75,000 acres have burned on the Chugach National Forest, with over 99 percent of that occurring on the Kenai Peninsula. The majority of the fires have been human-caused, and the average individual fire

has burned only 50 acres, with the range from ¼ acre or less to two fires that burned over 1,000 acres each. The average number of fires per year has been about 16. The larger fires mostly occurred prior to 1930 with the average individual fire size in the last decade averaging only 15 acres. The prescribed burns would thus exceed the long-term yearly average total burn amount of 800 acres. Because of the difference between the average fire size prior to 1930 and those after (Figure 3-15), the prescribed burns for any of the alternatives would fall within the known variation in fire size.

The historical high population of moose on the Kenai Peninsula prior to 1930 and smaller highs again in 1947 and 1969 were likely caused by the improved winter range that resulted from large fires (LeResche et al. 1974). In the absence of large wildfires, the prescribed fire regime in the alternatives would stabilize the amount of moose winter range on the Kenai Peninsula that would be created in any specific year. The creation of new winter range to replace that lost through normal forest succession would tend to stabilize moose populations on the Chugach National Forest portion of the Kenai area.

There is some uncertainty associated with the assumption of stabilizing moose browse production through the use of prescribed fire. Escaped campfires cause over 50 percent of the wildfires on the Kenai Peninsula. These fires average less than 15 acres per year, but may contribute to further browse production if the fires do not repeatedly burn the same area in successive years. Additionally, the Kenai portion of the Chugach National Forest is currently experiencing a massive outbreak of spruce bark beetle that may subject the closed needleleaf forest of over 43,000 acres to increased frequency and severity of natural wildfires. With such unpredictable, but likely, fires the amount of browse produced by prescribed fire under the alternatives is probably a minimum amount of browse production. Regardless, with prescribed fire, moose wintering habitat should remain healthy not just on the Kenai Peninsula but throughout the entire Chugach National Forest that currently supports moose.

Moose are thought to be comparatively tolerant to humans and have the ability to develop a high level of habituation (Shank 1979). In the winter, moose tend to move away from heavily used trails. In one study in Wyoming, 50 percent of the encounters between moose and snowmobiles resulted in displacement while 94 percent showed some form of disturbance. People on snowshoes or skis caused more disturbance than snowmobiles (Rudd and Irwin 1985). Collisions between moose and motorists on the Kenai Peninsula are also a severe problem (Del Frate and Spencer 1991).

Figure 3-42: Comparison of H.S.I. values when 3,300 acres per year of moose winter habitat are burned in the next 5 years and no management (natural succession).

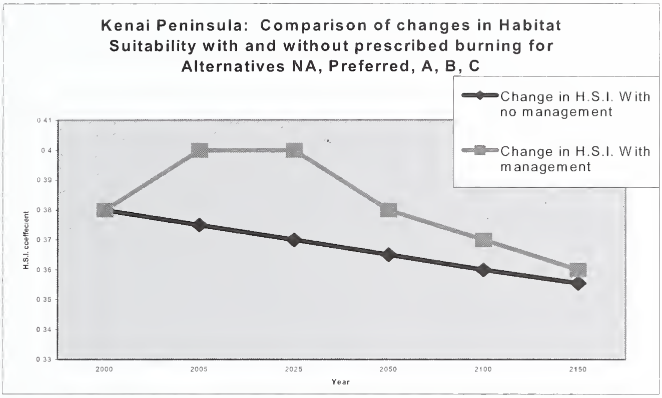
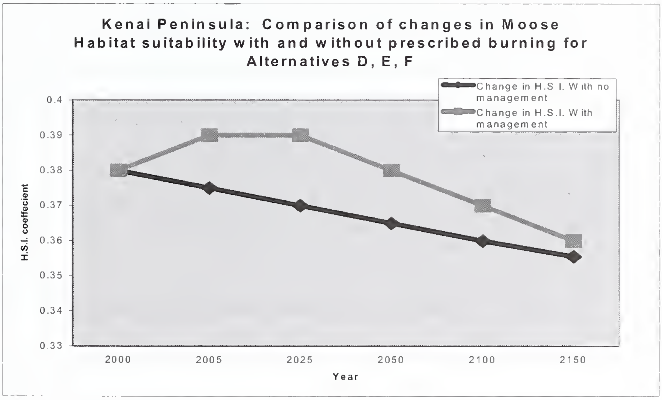


Figure 3-43: Comparison of H.S.I. values when 1,200 acres per year of moose winter habitat are burned in the next 5 years and no management (natural succession).



Mountain Goat

Mountain goats represent species using cliffs, alpine, subalpine, and old-growth habitats. The quantity and quality of the winter habitat is thought to be the most limiting factor for mountain goats in Southcentral Alaska (Suring et al. 1988). Mountain goats use old-growth forest habitat with trees having large dense crowns for winter shelter and as a foraging area. Mountain goats are usually found near escape cover, steep cliffs with slopes over 50 degrees. Forested habitat within one-quarter mile is highest value and value decreases out to one-half mile. Of the 5.45 million acres of Chugach National Forest, over 1.3 million acres (Table 3-48), or 24.5 percent, are mountain goat habitat. The maximum amount of proposed land management activities in Alternatives No Action, Preferred, A, B, and C is 45,000 acres in the first decade (Figure 3-17b), or less than 3.4 percent of the total available mountain goat habitat. Little to none of this proposed activity, however, is planned to occur in or adjacent to mountain goat habitat; therefore, Forest Service land management activities would not reduce the habitat below that amount available under the expected range of variability given current climatic conditions.

Mountain goats are sensitive to habitat change, disturbance and hunting pressure (Chadwick 1973). Aircraft disturbance can cause detrimental changes in mountain goats' energy balance, particularly when the goats are on winter range or kidding areas, where they are undergoing seasonal nutritional and energetic stress exclusive of anthropogenic disturbances. Such disturbance can occur as far away as 2 kilometer from a helicopter flight (Cote 1996). Long- and short-term effects of activities on mountain goats were considered. Developments near winter range would have long-term effects on individuals or herds. Aircraft overflights are a short-term limited duration activity. Based on an analysis of the effects of heli-skiing on the Kenai Peninsula, approximately 4 to 10 percent of the goat population in the project area would be affected 3 percent of the time (USDA Forest Service 1999f). The long-term effects of heli-skiing on mountain goats are being monitored in cooperation with ADF&G (USDA Forest Service 2000c).

Forestwide standards and guidelines for mountain goat habitat management were developed to reduce the effects from aircraft overflights. Timing guidelines would also apply (see Revised Forest Plan, Chapter 3).

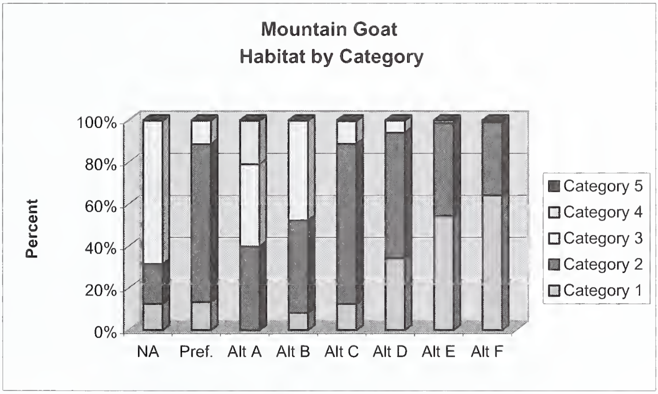
The differences among alternatives are shown in Figure 3-44. Ranked in order of increasing risk to mountain goat habitat abundance and availability are Alternative F, E, D, C, Preferred, B, A, and No Action.

Few of the management activities have potential to directly modify mountain goat habitat. The direct habitat modification due to utility towers or alpine campsites is not considered to have a major impact. Forestwide guidelines implemented at the project level will prohibit locating long-term concentrated human activities, such as permanent campsites at least one mile from winter range or kidding habitat (Revised Forest Plan, Chapter 3). Indirect effects from Forest Service permitted helicopter access for heli-skiing or heli-hiking has the greatest potential for indirect effects on the mountain goat herd. The likelihood of these activities

affecting the viability of the mountain goat population on the Forest is low. Forest Service permitted helicopter-based activities, such as fly-in skiing and hiking, would limit their potential disturbance of mountain goats by avoiding occupied winter habitats, and by avoiding landings during the kidding (and Dall sheep, lambing) period of May 15 through June 15 (USDA Forest Service 2000c, 1999f). Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest.

Predation, both human and animal, may detrimentally affect some local populations of mountain goats, but these factors are beyond the prediction or control of the Forest Service. None of the alternatives and their accompanying standards and guidelines is anticipated to reduce the availability of habitat for mountain goats beyond that currently within the expected range of variability under current climatic conditions. Accordingly, any vacated habitats will be available for future recolonization.

Figure 3-44: Distribution of potential mountain goat habitat on the Chugach National Forest by prescription category (1,336,300 acres).



Species of Special Interest

Gray Wolf

The Southcentral Alaska gray wolf populations were nearly extirpated in the 1920s, but have since recolonized the area. The wolves on the Kenai Peninsula were supplemented by a transplant from the 40 Mile area, east of Fairbanks near the Yukon border, in 1998 (ADF&G 2001a). Wolves have only recently moved into the Copper River Delta (Carnes et al. 1996).

Winter recreation has the potential to affect gray wolf movements and habitat use during periods of winter foraging and early spring denning. Studies of snowmobile use and wolf movement have shown that wolves tended to avoid areas of snowmobile activities in restricted use areas (USDI National Park Service 1996). Winter activities that compact snow, such as snowmobiling and cross-country skiing, provide travel routes into areas that may otherwise be inaccessible because of deep snow (Praguet et al. 2000).

Roads and mortality from increased hunting and trapping is a concern for the Copper River Delta gray wolf. The relatively low population (less than 50 animals) could be at risk of extirpation if hunting or trapping mortality increased. Increased mortality of wolves is a common effect due to increased road access (Carnes et al. 1996).

Maintaining abundant populations of prey species, controlling access on new roads and working with ADF&G to reduce or eliminate illegal harvest are the primary mitigation measures considered for this analysis

The differences in potential effects from management activities are shown in Figures 3-45a and b. No change in the Copper River Delta road density would result under any alternative. Currently, there are 19 miles of road resulting in a total density of 0.006 miles of road per square mile of area. The proposed Carbon Mountain Road, is not under Forest Service control, would add an additional 30 miles of road for a total road density of 0.015 miles of road per square mile of area. These road densities are well below the threshold of approximately 0.4 miles/square miles above which wolves are likely to be extirpated (Thurber et al. 1994).

The likelihood that the viability of wolves on the Forest would be affected by management activities is low. Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest. Random, stochastic events may reduce localized wolf populations and even affect the viability of individual packs. Such reductions have occurred in the past for various reasons, but wolves have successfully recolonized the area and recolonization would likely reoccur. Such recolonization could occur from wolves extrinsic to the Chugach National Forest, or, more likely, from the majority of the Forest that would remain free of management activities deleterious to wolves and wolf habitat under any alternative.

Figure 3-45a: Distribution of potential gray wolf habitat on the Chugach National Forest by prescription category (2,742,210 acres).

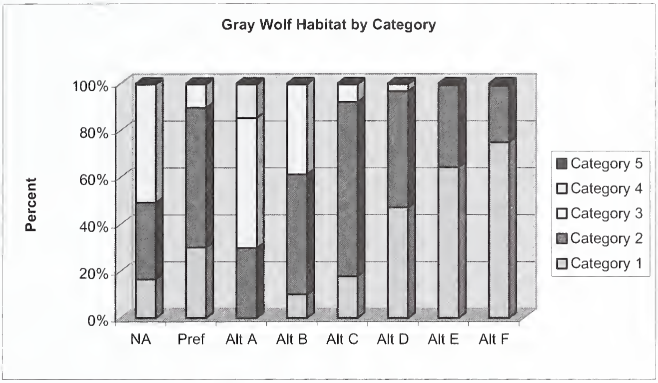
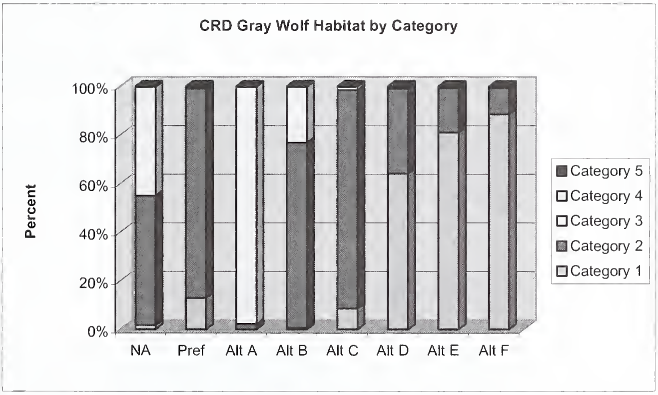


Figure 3-45b: Distribution of potential gray wolf habitat on the Copper River Delta by prescription category (783,740 acres).



Lynx

Lynx is a wide-ranging carnivore that is associated with the early seral broadleaf boreal forests. Its population fluctuates with changes in its primary prey species, snowshoe hare. The populations of lynx on the Forest are thought to be stable and within the range of historic viability.

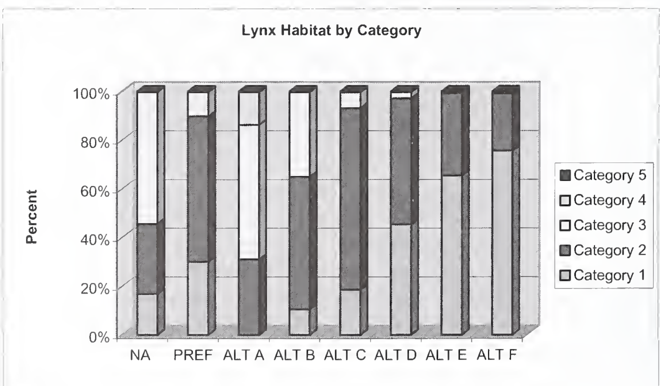
Risks to the viability of the lynx populations on the Forest include loss of early seral habitat necessary for prey abundance, and direct mortality associated with hunting and trapping. New roads and trails creating new access for trappers and hunters also affect lynx. Fragmentation and perforation of movement corridors by roads and developments may have reduced the ability of lynx to move to and from the mainland from the Kenai Peninsula (Bailey et al. 1986).

The differences between the potential effects of the alternatives are shown in Figure 3-46.

Changes in forest structural conditions from timber harvest, prescribed burning, and mechanical treatments may increase habitat for the lynx for the short term. The long-term effects of timber harvest and prescribed burning are not likely to affect the population viability of lynx on the Forest. Only a small percent of the total forest will be modified into early seral stages by any of the alternatives, and then only under favorable conditions.

Nonmotorized recreation activities, such as backcountry cross-country skiing or snowshoeing, may affect lynx, because the disturbance associated with these activities is dispersed and unpredictable (Gabrielsen and Smith 1995). Snowmobiling may be particularly adverse to lynx because this activity occurs when animals are frequently in poor condition due to winter stress (Anderson 1995).

Figure 3-46: Distribution of potential lynx habitat on the Chugach National Forest by prescription category (2,665,700 acres).



Marbled Murrelet

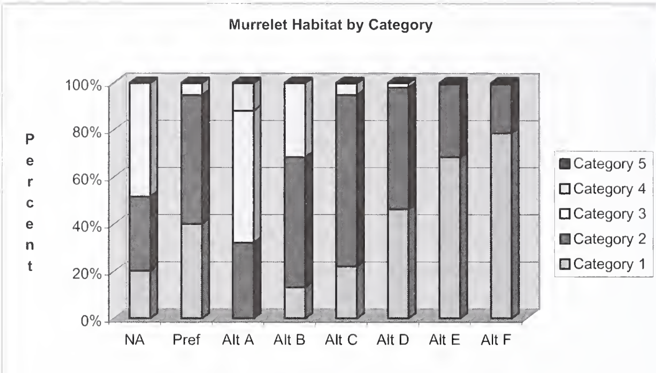
Marbled murrelets are considered to be an old-growth-related species, nesting where suitable mossy nesting platforms occur in forested stands. The current population of marbled murrelets in Prince William Sound is approximately 54,000, down from 159,000 in 1993 (Kuletz personal communication). Risks to murrelet habitat include timber harvest, insects and diseases, and fires. The differences among alternatives are shown on Figure 3-47.

Forestwide standards and guidelines were developed that may provide some protection from forest management activities. Timber harvest would only occur in four watershed associations out of 96 on the Forest. Total harvest proposed in Alternative A, would amount to less than one percent of the available old growth in Prince William Sound. This alternative proposes more timber harvest than any of the others that are under consideration. Other alternatives would harvest less old growth. The likelihood that this level of management activities would affect the viability of marbled murrelet populations is low under all alternatives.

There is a degree of uncertainty regarding the future of the remaining old growth habitats in relation to bark beetle activity. The species has likely encountered similar events in the past, and adaptive strategies may exist. An unknown portion of the murrelet population in Southcentral Alaska nests on the ground, or in crevices along rocky cliffs (Mendenhall 1992). Ground nesting may increase as the old growth conifer habitats continue to decline. Timber stands which are not affected by bark beetles or timber harvest will continue to provide nesting habitat.

Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest. However, some local populations are more ephemeral because of reduced population levels and increased susceptibility to environmental extremes and stochastic (random) events associated with reduced habitat abundance and distribution. Vacated habitats may become recolonized in the future.

Figure 3-47: Distribution of potential marbled murrelet habitat on the Chugach National Forest by prescription category (1,455,520 acres).



Montague Island Hoary Marmots

Montague Island hoary marmots are thought to use alpine and talus slope habitats. They graze on grass and other herbaceous materials close to den sites.

Not much is known about the Montague Island hoary marmot or risks to its population viability. Road construction was considered to be the greatest risk to this species for this analysis. Road building and logging activities which cross talus slopes may affect the hoary marmot. Road construction in alpine meadow habitat would adversely affect the marmot, but this is unlikely to occur. Logging traffic has the potential to result in road kill of individuals.

Alternative A would pose the greatest potential risk to the population followed by B and the No Action, while the rest would all be similar in potential effects.

Project-level analysis for projects proposed on Montague would analyze the potential effects of those proposals on the species and its habitat.

There have been a few past projects that have modified habitat for the Montague Island hoary marmot, but the habitat is considered to be mostly intact. The effects of the introduction of deer and mink to the island on hoary marmots are unknown.

Risks to the Montague Island hoary marmot are low because harvest activities and road construction would not occur in alpine habitats. Uncertainty is high. There are very few records of the species and the status of the population, size, distribution, and habitat use is unknown.

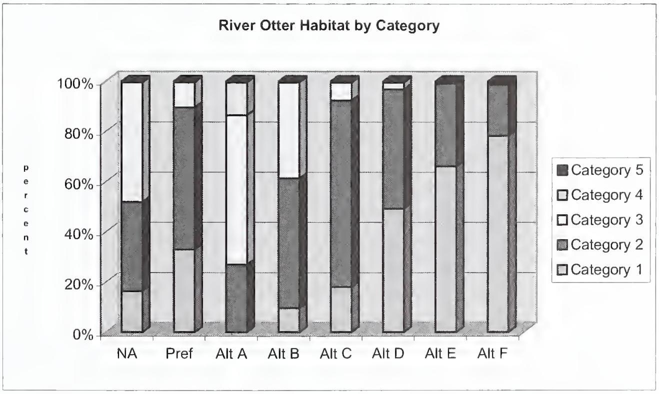
River Otter

River otters are common residents of coastal Alaska. They use the riparian areas, protected inlets, and coves. Individual otters have a home range that meets their needs for escape cover, denning habitat, and foraging areas where they feed on fish and marine invertebrates. They were considered a damaged species from the *Exxon Valdez* oil spill and are considered to be a recovered population. The differences in alternatives are shown in Figure 3-48.

The likelihood of forest management activities affecting the habitat viability of river otters on the Forest is low because project level analysis and implementation will apply the Forestwide standards and guidelines as mitigation for possible affects. Habitat for river otters would be protected under the forestwide sensitive area guidelines. Riparian habitats would also be maintained by application of fisheries, brown bear, and seasonal waterfowl standards and guidelines.

There is concern for the risks to the river otter posed by the projected increase of visitors to Prince William Sound through Whittier and the associated recreational development to accommodate them. It is impossible to predict the amount of recreational use of Prince William Sound shorelines, so some limited areas of river otter habitat may be adversely affected by intermittent human disturbance. Standards and guidelines for sensitive areas and other riparian-dependent species will limit disturbances to river otter habitat and prohibit long-term concentrated human activities in certain areas (Revised Forest Plan, Chapter 3, Forestwide Direction). Shoreline habitat in the Prince William Sound area of the Chugach National Forest is abundant, so river otter habitat would continue to remain well-distributed throughout the planning area.

Figure 3-48: Distribution of potential river otter habitat on the Chugach National Forest by prescription category (1,981,100 acres).



Sitka Black-tailed Deer

Sitka black-tailed deer are found throughout the islands and mainland of Prince William Sound. They use alpine and needleleaf habitat during the summer, and old-growth forest below 800 feet elevation during the winter. Loss of winter habitat would be the biggest risk to the Sitka black-tailed deer. Currently the population in Prince William Sound is considered to be at a moderate to high density.

Sitka black-tailed deer are an important subsistence resource for rural residents of the Chugach National Forest. There is a concern that proposed management activities could reduce the populations of deer in Prince William Sound. Harvest levels reported by hunters exceed ADF&G harvest objectives (ADF&G 1999a).

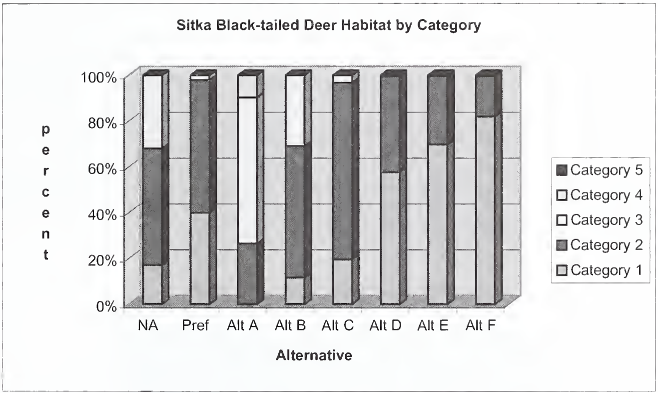
The differences in alternatives are shown in Figure 3-49.

Alternatives A, B and No Action would harvest timber, some of which would be on Montague Island where the highest harvest of Sitka black-tailed deer within the Prince William Sound area occurs. There is no scheduled timber harvest under Alternatives Preferred, C, D, E, and F. Such harvest would have an effect on the Montague Island Sitka black-tailed deer habitat, and potentially on those who depend on Sitka black-tailed deer for sport and subsistence purposes. Alternative A has the highest level of timber harvest at 3,250 acres to be harvested in Prince William Sound over the next decade. If all 3,250 acres were harvested off Montague Island and all the harvest area were concentrated in high value deer habitat, the total reduction of high value Sitka black-tailed deer habitat on Montague Island would be 9 percent, leaving 91 percent of the Montague Island high value Sitka black-tailed deer habitat remaining. Accordingly, this worst-case scenario would have an effect on a few specific sites, but would not affect the overwhelming majority of Sitka black-tailed deer habitat on Montague Island. In actuality, the effect on Montague Island Sitka black-tailed deer habitat would be less than this worst-case estimate. The entire potential 3,250 acres of timber harvest is not planned for Montague Island, nor is it planned to occur entirely in high value Sitka black-tailed deer habitat. Thus, the effect on Montague Island Sitka black-tailed deer habitat would be lessened, and the effect on the Sitka black-tailed deer habitat within the entire Prince William Sound area would be negligible.

There are approximately 456,420 acres of high value Sitka black-tailed deer habitat in the Prince William Sound area (of which only about 8 percent is on Montague Island). If all 3,250 acres potentially available for harvest under Alternative A were to be harvested in high value Sitka black-tailed deer habitat, the maximum reduction throughout the Prince William Sound area would be less than one percent. As noted, the entire potential harvest of 3,250 acres in the Prince William Sound Area is not planned to occur entirely in high value Sitka black-tailed deer habitat. Under any alternative, Sitka black-tailed deer habitat will be of sufficient quality, abundance, and distribution to allow the species to maintain healthy populations through the Prince William Sound area and the entire Chugach National Forest.

Sitka black-tailed deer populations fluctuate, primarily in response to the severity of winter weather. A winter of shallow snow cover allows Sitka black-tailed deer populations to increase while a winter with deep snow causes losses to the population, and a very severe winter may cause loss of up to 80 percent of the population (Reynolds 1979). It is to be expected that some populations or groups of Sitka black-tailed deer are ephemeral in nature, surviving in limited or marginal habitats. The groups persist during a period of mild winters, then are extirpated during a hard winter, and the area is recolonized during successive mild winters from expanding populations in adjacent higher quality habitats. These populations must be the exception rather than the rule, else harvest of Sitka black-tailed deer over the past decades would have not remained fairly constant or even increasing over the long-term. None of the alternatives considered have the potential to change things. Sitka black-tailed deer populations on the Chugach National Forest will remain viable.

Figure 3-49: Distribution of potential Sitka black-tailed deer habitat on the Chugach National Forest by prescription category (1,239,620 acres).



Townsend's Warbler

Townsend's warblers are locally abundant throughout the Chugach National Forest (Andres 1998). The Townsend's warbler is a neo-tropical migrant, breeding in Alaska and wintering from California to Nicaragua. They are largely restricted to mature forests with tall coniferous trees, and are abundant in large undisturbed tracts of contiguous forest, but will also use forests in late successional stages (Matsuoka et al. 1997).

No significant population trend data was detected from data collected by the Breeding Bird Survey, but the species may not be monitored with sufficient intensity to detect a trend in the population (Peterjohn et al. 1995). Populations of birds may be susceptible to traditional timber harvest methods of clearcutting and even-aged management (Wright et al. 1998). These harvest methods result

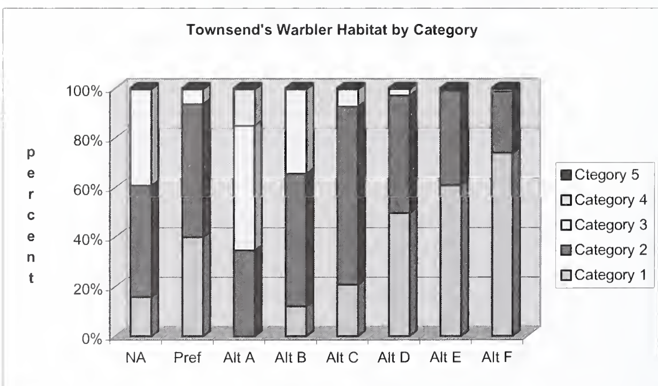
in loss of habitat features Townsend's warblers have been found to select (Matsuoka et al. 1997). This species may be most negatively affected by habitat loss in spruce stands with heavy spruce beetle mortality (Collins et al. 1998).

Forest management activities such as timber harvest, forest restoration, and prescribed burning would all have an effect on this species. The likelihood of these activities affecting the viability of the species on the Forest is low because 20 percent of the timber to be harvested would be cut using an uneven-aged prescription. Forestwide standards and guidelines for riparian areas and soils will provide large, tall mature trees along streams and within the managed stands. In addition, snag and green tree retention guidelines would provide a legacy of mature trees in the regenerating stand.

Timber harvest proposed in Alternatives A, B and No Action would have an effect on the Townsend's warblers in the project areas. Townsend's warbler habitat is well-distributed throughout the Forest, and the relative amount of forest modified would be small. The differences among the potential effects of the alternatives are shown in Figure 3-50.

Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest. However, some local populations are more ephemeral because of reduced population levels and increased susceptibility to environmental extremes and stochastic (random) events associated with reduced habitat abundance and distribution. Vacated habitats may become recolonized in the future.

Figure 3-50: Distribution of potential Townsend's warbler habitat on the Chugach National Forest by prescription category (734,280 acres).



Kenai Wolverine

Wolverines occur in small numbers throughout mainland Alaska primarily found in the remote areas of the state. This little-known carnivore has been characterized as one of North America's most rare mammals (Banci 1994). The Kenai Wolverine *(Gulo luscus katschemakensiis)* was described by Matschie in 1918 from the Kachemak Bay area of Southcentral Alaska and is known only from the Kenai Peninsula (Hall 1981).

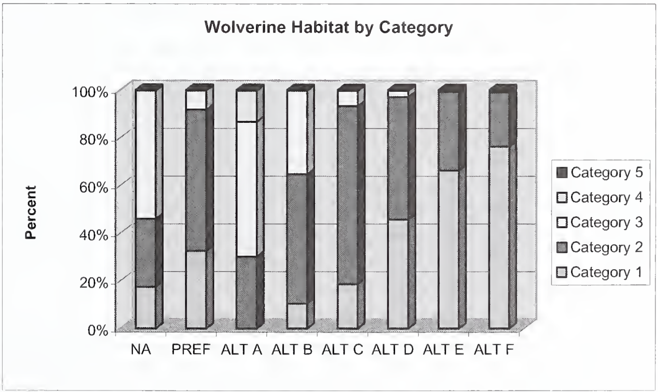
The wolverine is an animal of montane forest, tundra, and taiga. Other habitat parameters such as escape cover from predators, availability of den sites, prey concentrations, and cover can affect daily movement and habitat use patterns (Howell 1999).

Human access on snowmobiles in the winter or early spring could cause behavioral disturbance. This disturbance may impair kit survival if females use less secure den sites, however, neither construction of new motorized access points nor significant changes in existing snowmachine use is planned.

The following risk factors were considered in this analysis: big game winter range, refugia, human access and development, identification and conservation of important areas, wolverine harvest, and predator complex (Howell 1999).

The differences among the potential effects of the alternatives are shown in Figure 3-51.

Figure 3-51: Distribution of potential wolverine habitat on the Chugach National Forest by prescription category (3,153,870 acres).



The prescribed fires, which are proposed on the Kenai Peninsula, would increase the amount of forage for moose on the winter range. This has the likelihood of increasing 1) wolf kills, 2) human harvest carcasses, and 3) winter kills in severe winter, all of which can provide carrion for wolverines. The potential increase in moose populations and the winter kill in severe winters would increase the likelihood of wolverines finding carrion.

Increased road building, leading to increased human access, is not planned for the Chugach National Forest portion of the Kenai Peninsula. Howell (1999) identified human harvest of wolverines as a major mortality factor, and suggested that the populations might be declining as a result of over harvesting. Stable or decreasing the current access by humans for hunting and trapping of wolverines would not contribute to an increased loss of wolverines. Sport hunting/trapping take is outside the purview of the Forest Service. It is anticipated that the total available wolverine habitat would not decline on the Kenai Peninsula, thus maintaining viable populations of wolverine in the area.

Risks to the wolverine population or its habitat resulting from Forest Service management or permitted activities under any alternative are low. In some alternatives, long-term benefits from increased food supply caused by prescribed fire may be partially negated by large increases in winter motorized activities, but the trade-offs are not clear. Increases in snowmachine use are not likely in the steep alpine terrain often used for denning (Magoun 1995, Golden 1996), so any potential disturbance of individual females with young would be tempered by the overall increase in food for the population from prescribed fire or other vegetation manipulation. Effects from beneficial to neutral would result in decreasing rank order from the Alternative Preferred, No Action, C, B, A, D, E, and F. Direct mortality to wolverines resulting from hunting or trapping is not under the purview of the Forest Service and may influence the total amount of occupied available habitat. The unique genetic heritage of the Kenai wolverine cannot be replaced by recolonization of abandoned habitats by wolverines from outside the Kenai Peninsula.

Bald Eagle

Bald eagle nest protection standards are outlined in an Interagency Agreement with the U.S. Fish and Wildlife Service. There is a 330-foot retention zone around known eagle nest locations. There are also blasting, road constriction, and overflight restrictions. The active bald eagle nesting season is generally from March 1 to August 31.

Bald eagles are generally food-stressed during winter. High levels of human activities can potentially increase stress on winter bald eagles and result in increased mortality rates (Stalmaster and Gessaman 1984). Snowmobiles may be especially disturbing, probably due to random movement, loud noise, and operators who are generally exposed (Walter and Garrent 1981). Grubb and King (1991) found that pedestrians (hiker, anglers, and hunters) were the most disruptive type of human activities to bald eagles. All alternatives are considered to have similar effects.

The likelihood of management activities affecting viability of the populations of bald eagles on the Forest is low because the Forestwide standards will be applied to protect nest sites. Implementation of these standards and guidelines is expected to prevent any adverse effects on bald eagle populations and habitats and not result in a loss of species viability.

Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of viability.

Northern Goshawk

At the present time, the only documented northern goshawk nests on the Forest are on the Copper River Delta and on the Kenai Peninsula.

Factors limiting northern goshawk populations on the Chugach National Forest are unknown but are considered to be similar to those described for Southeast Alaska. Timber harvest is considered to be the primary threat to nesting populations (Reynolds 1989, Crocker-Bedford 1990). However, forest harvest may be compatible provided habitat needs are provided at multiple scale levels (Reynolds et al. 1992; Squires and Reynolds 1997). Additional research and monitoring are needed to identify the factors that may currently be limiting to northern goshawk populations

In Southeast Alaska, goshawks exhibit a significant preference for productive old-growth forest, the general avoidance of all other habitat types, and a predominate use of lower elevations (less than 1,200 feet) and relatively gentle slopes (less than 35 percent) (Iverson et al. 1997).

The following Forestwide guidelines have been developed for northern goshawk habitats on the Forest:

1. Protect active goshawk nesting habitat. Active nests should have a forested 300-acre wind-firm zone (approximately 2000-foot radius) where available. Road construction through the zone is discouraged. Prevent continuous disturbance within 660-feet of the nest during the active nesting season (generally March 1 to July 31).
2. Conduct annual goshawk nest activity monitoring for not less than two years after discovery of active nests. If the previously active nests remain inactive for two consecutive years, protection measures for the site may be removed.

Implementation of these standards and guidelines coupled with additional research and monitoring is expected to prevent any adverse effects on northern Goshawk populations and habitats and not result in a loss of species viability.

The overall risk to northern goshawks is considered to be low and the same for all alternatives. The likelihood of forest management activities affecting the viability of the populations of northern goshawk on the Forest is low because the Forestwide standards and guidelines will be applied to protect nest sites.

Implementation of these standards and guidelines is expected to prevent any adverse effects on northern goshawk populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of viability.

Threatened and Endangered Species

Formal and informal consultations procedures (as directed by the Endangered Species Act, as amended in 50 CFR 17.7, and Forest Service Manual 2670) are used with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service on all projects that implement the Revised Forest Plan. Forestwide standards and guidelines (see Revised Forest Plan, Chapter 3) for Threatened, Endangered, and Sensitive species direct that all projects will comply with requirements of the Endangered Species Act, as amended and Forest Service policy (FSM 2670). (see Appendix G).

Sensitive Species

Dusky Canada Goose

Environmental consequences for dusky Canada goose were covered in the discussion regarding MIS.

Montague Island Tundra Vole

At the present time, the Montague Island vole is known only from Montague Island. The potential habitats include all Land Cover Classes on the island.

Factors that limit Montague Island voles are unknown. Loss of habitat, predation, and disease may contribute to fluctuations in populations of this species. Timber harvest and road construction would have a direct effect on tundra vole habitat. Use of OHVs could indirectly influence the habitat for this species, especially through winter operations in the beach fringe habitats (Lance 1999b).

Alternatives that would allow timber harvest, road construction, or developed facilities would pose the greatest direct affect on tundra vole habitat on Montague Island. Activities that directly remove tundra vole habitat, such as road construction or developed facilities, would remove a small amount of habitat from the overall available habitat base of about 304 square miles, but the collateral disturbance at the road's edges or around the edges of developed facilities would provide some preferred early seral habitat. Alternatives A, B, and the No Action Alternative propose a maximum timber harvest of 3,250 acres over the nest decade. If all the harvest were scheduled for Montague Island, which it is not, the total alteration of potential Montague Island tundra vole habitat would amount to about 1.5 percent of that available to the vole. Mature coniferous forest is less preferred than early successional habitat, so the habitat change would temporarily provide more preferred habitat for the tundra vole before declining again to its background value. The other alternatives do not propose timber harvest or road construction on Montague Island and therefore would not affect the existing habitat for the tundra vole.

None of the tundra voles' habitat is in short supply, but some types appear to be preferred over others. Beach fringe is a preferred habitat of Montague Island tundra voles and Forestwide riparian area protective standards and guidelines would limit disturbance to the preferred habitat. The tundra vole is a habitat generalist and none of the Forest Service's management or permitted activities under any alternative have the potential to adversely affect the viability of the Montague Island tundra vole population or its habitat.

Osprey

There are no known osprey nests on the Chugach National Forest. Limiting factors for osprey populations are unknown, but availability of nest sites and foraging areas do not appear to be limiting. Osprey are sensitive to nest site disturbances during the nesting and brood rearing season. The Forestwide standards and guidelines (see Revised Forest Plan, Chapter 2) have been developed to provide for protection of nest sites as they are identified.

All alternatives are considered to have similar effects. The likelihood of forest management activities affecting the viability of the populations of osprey on the Forest is low because the Forestwide standards and guidelines will be applied to protect nest sites. Implementation of these standards and guidelines is expected to prevent any adverse effects on osprey populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of viability.

Peale's Peregrine Falcon

The U.S. Fish and Wildlife Service maintains a database with confidential locations of all known nest sites of Peale's peregrine nest locations in Southcentral Alaska. Potential habitats include tall rocky cliffs and rocky bluffs.

The likelihood of forest management activities affecting the viability of the populations of Peale's peregrine falcon on the Forest is low because the Forestwide standards and guidelines will be applied. The Forestwide standards and guidelines for Seabird Rookeries, and Waterfowl and Shorebird habitats will also maintain foraging habitat for the falcon.

The effects of all alternatives are considered to be the same. Implementation of the Forestwide standards and guidelines is expected to prevent any adverse effects Peale's peregrine falcon populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of species viability.

Trumpeter Swans

At the present time, the only documented nesting habitat for trumpeter swans on the Forest is on the Copper River Delta and the Twentymile Drainage on the Kenai Peninsula. All of the nesting habitat would be classified as wetlands and/or riparian habitat.

Factors that limit trumpeter swan populations are unknown. Nesting, brood rearing, and wintering habitats for trumpeter swans are associated with streams, rivers, lakes and ponds. Swans seem to be more tolerant of humans during the

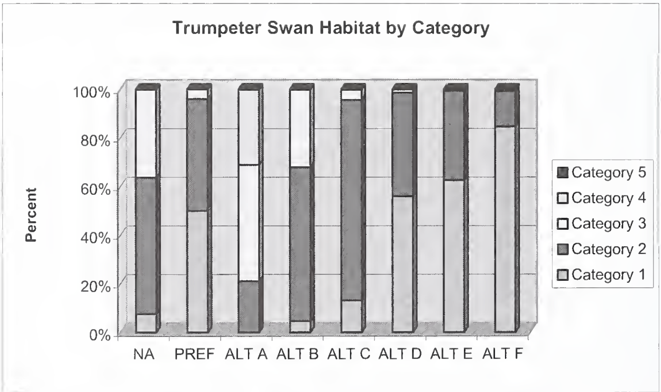
winter months, but display reduced tolerance as spring approaches. Nesting and brood rearing seasons are critical for swan survival and production. Disturbance by humans could have negative effects on trumpeter swans and other waterfowl. Standards and guidelines have been developed to provide for their habitat. Implementation of these standards and guidelines coupled with additional research and monitoring, is expected to prevent any adverse effects on trumpeter swan populations and habitats and not result in a loss of species viability.

The following Forestwide guideline has been developed for trumpeter swan habitats on the Forest:

1. Maintain a 2,640-foot (1/2 mile) no disturbance buffer around active trumpeter swan nests to ensure their solitude and maintain viable nesting habitat.

Figure 3-52 shows how the amount of potential trumpeter swan habitat varies by prescription category and alternative.

Figure 3-52: Distribution of potential trumpeter swan habitat on the Chugach National Forest by prescription category (628,410 acres).



The likelihood of forest management activities affecting the viability of the populations of trumpeter swans on the Forest is low because the Forestwide standards and guidelines will be applied to protect nest sites.

Implementation of these standards and guidelines is expected to prevent any adverse effects on trumpeter swan populations and habitats and not result in a loss of species viability. Therefore, any alternative may affect individuals, but is not likely to contribute to a loss of species viability.

General Effects

Overall direct and indirect effects on wildlife (all species)

Effects on wildlife from fisheries management

Managing fish habitat usually consists of in-stream structural or riparian habitat improvement projects. Normally both of these management tools would result in higher quality habitat conditions for riparian-associated species. Alternatives No Action, Preferred, A, B, C, D, and E provide the greatest opportunity to use these management tools for increasing riparian habitat conditions. Alternative F provides for a lower level of riparian habitat management.

Effects on wildlife from fire management

The area of the Chugach National Forest exclusive of the Kenai Peninsula is in the coastal forest type, which is dominated by uneven-aged single tree replacement successional dynamics. Fires are virtually nonexistent and play little to no part in the dynamics of the Forest. Rather, single trees, or small groups of trees, senesce, die, and fall, forming a small gap in an otherwise closed canopy and allow seedlings and other understory vegetation to become established. Except in rare instances at the edge of such forest, wildlife habitat is little influenced by fire or fire management. This is not true of the Kenai Peninsula portion of the Chugach National Forest.

The forests of the Kenai Peninsula are interior boreal forest modified by the maritime influence of coastal climate. The fire history prior to the late 1800s of the Kenai Peninsula is unknown. Within burns that occurred after 1900, remnants of stumps and residual trees suggest that a climax forest with features of the coastal forest may have existed prior to the burns (Potkin 1997), but all the members of the current vegetational community were present 2,500 years ago (Ager 2000b). What is known is that the Kenai Peninsula vegetation is now extensively influenced by fire (Potkin 1997, Vierieck et al. 1992). From 1914 to 1999 about 75,000 acres have burned on the Kenai Peninsula. The majority of the fires have been human-caused, and the average individual fire has burned only 50 acres, with the range from ¼ acre or less to two fires that burned over 1000 acres each. The average number of fires per year has been about 16. The larger fires mostly occurred prior to 1930 with the average individual fire size in the last decade averaging only 15 acres.

Effective fire control since the mid-1900s has limited the size and intensity of the fires and resulted in much late-successional spruce and hemlock forest. Coinciding with the preservation of climax forest and the aging of the previously burned forest, extensive spruce bark beetle outbreaks have occurred on the Kenai Peninsula (see Figure 3-16). As the infested trees die and increase the availability of burnable fuels, wildfires are likely to increase in number and size. Lightning strikes are relatively rare and most of the recent fires have been human caused. These fires have, and will continue to, greatly influence the amount and availability of early- to mid-successional wildlife habitat on the Kenai Peninsula.

Managed fire can have a positive effect on wildlife habitats by increasing the amount and availability of plant nutrients, and by increasing the diversity of

vegetation, especially in early successional stages. Fire can be used as a primary management tool for improving and stimulating changes in wildlife habitat, particularly in creating early successional conditions that are favorable to big game management.

Although the current fire frequency may be higher than that of the distant past, the frequency of fires in the 1900s is within the expected range of variability under current climatic conditions, and the species such as moose, snowshoe hares, and their dependent predators, are within that expected range of variability. Alternatives that include the use of prescribed fire would maintain vegetation that is within the expected range of variability, even should occasional wildfires occur. Alternatives that emphasize improvement of wildlife habitat through active wildlife management would result in a greater use of prescribed fire for creating desired successional conditions. The greatest opportunity to use fire as a management tool to increase early seral conditions and to improve structural diversity are Alternatives No Action, Preferred, A, B, and C (see Table 3-35).

Effects on wildlife from insects and disease management

Forest insects and diseases have always been a natural component of the Forest. Along with fire, they were some of the most important disturbance agents in creating the current composition, structures and patterns of wildlife habitats.

On the Chugach National Forest exclusive of the Kenai Peninsula, uneven aged climax forests predominate. Insects and disease affect single trees, or small groups of trees, that senesce, die, and fall, forming a small gap in an otherwise closed canopy and allow seedlings and other understory vegetation to become established (Veblen and Alaback 1996). On the Kenai Peninsula, disease and insects play a more extensive role in forest dynamics. The forests of the Kenai Peninsula are currently experiencing a widespread spruce beetle infestation, particularly in those areas that have a more even-aged forest structure resulting from previous stand replacing disturbances (USDA Forest Service and State of Alaska 2000).

Many species of wildlife (such as lynx, marten, and three-toed woodpecker) depend on snags or downed woody material for sustaining portions of or all of their life requirements. Unique snag and downed woody dependent species may benefit most from periods of increased insect and disease activity. The alternatives do not differ significantly for predicted levels of endemic insect and disease activity. The less frequent epidemic outbreaks can have negative effects on wildlife habitats in several ways. Some examples include reductions in standing live biomass for species associated with late successional and old-growth habitats and removal of large areas that provide cover and security habitat for big game species.

Timber harvesting and related silvicultural activities can provide a tool for preventing or reducing the risk of a large insect or disease outbreak that may have negative effects on wildlife habitats for certain species. Areas in which timber stand improvement projects are proposed have the greatest opportunity to

reduce stand density and thereby reduce the risk to large insect and disease outbreaks The acres available for timber stand improvements would be greatest in the Alternative No Action, A, and B. The opportunity for treatment would be much less in Alternatives C, D, E, F, and the Preferred Alternative.

Effects on wildlife from mineral exploration and extraction
Impacts to vegetation and disturbance effect to wildlife species would result from the construction and maintenance of roads and well pads during development and extraction. Only one exploration well is predicted to occur under the reasonably foreseeable level of development in any ten-year period. Applying Forestwide standards and guidelines to the lease would require close coordination of any proposed actions with the State of Alaska, U.S. Fish and Wildlife Service, Bureau of Land Management, and others.

No new lands would be made available or be authorized for leasing under any alternative. There are no changes in authorization in Alternatives B, E and F. In Alternative D, 4,500 fewer acres are authorized and 10,000 fewer acres are authorized in Alternatives C and No Action. Timing stipulations are increased from none in the No Action to 17,500 aces in Alternatives D, E, and F, about 60,000 acres in the Preferred, and to over 100,000 acres in Alternatives A, B, and C. The cumulative impacts of these increases in protection stipulations are expected to reduce the overall effects of disturbance on many wildlife species.

For individual project proposals, site-specific environmental analysis will include detailed surveys for MIS, SSI and TES species, and the project environmental analysis and Biological Evaluation that analyze the effects of those proposals on wildlife and habitats. As a result of that analysis, appropriate mitigation measures would be included in the project to sustain the Peale's peregrine falcon and its habitat. The Forestwide standards and guidelines for Seabird Rookeries, and Waterfowl and Shorebird habitats would also maintain foraging habitat for the falcon.

Effects on wildlife from recreation management
Certain types of recreational activities can result in the direct loss of wildlife habitat, disturbance, and temporary displacement of wildlife species. In general, developed recreation sites would not significantly change the composition or pattern of wildlife habitats across the Forest. Effects on wildlife would primarily be associated with increased disturbance from the recreationist. On the Kenai Peninsula, wildfires have affected the wildlife habitat by replacing late successional forest with early- to mid-successional vegetation beneficial to moose and other wildlife dependent upon such vegetation. The majority of wildfires have been human-caused such as those from escaped campfires.

Any expansion or construction of new facilities would include a biological evaluation to determine the effects to proposed or listed species as well as disclose the effects to species identified by the Regional Forester as needing additional management consideration.

Studies concerning the effect of visitors on mountain goats and their habitat applicable to the situation in the Chugach National Forest are few, and are non-

existent for Dall sheep. In Glacier National Park, visitor activity that was confined to established viewing sites did not affect mountain goat behavior or use of mineral licks, but unmanaged visitor activity and excessive truck noise on the highway did (Pedevillano and Wright 1987, Singer and Doherty 1985, Singer 1978). Because unmanaged visitor activity and abrupt changes in engine noise from the use of jake brakes affected goat behavior, even in a habituated population, viewing sites should be:

- situated so use by large commercial semi-truck and trailer rigs is discouraged;
- constructed so that abrupt gear changes are not necessary for vehicles entering and exiting the viewing area; and,
- constructed and managed (through visitor use signs) so that departures on foot away from the viewing area are discouraged.

The situation in Glacier National Park occurs adjacent to a mineral lick that is in close proximity and at a similar elevation to the highway and the viewing area. The high attractive value of the lick to the goats and the comparatively heavy traffic levels on U.S. Highway 2 in Glacier Park has at least partially habituated the goats there. The distance from the lick to the viewing site at Glacier National Park is 150 meters. On the Chugach National Forest, the lighter, more irregular, traffic levels argue for a longer avoidance distance for observation sites from goat habitat. Doubling the distance to 300 meters and ensuring that it is constructed below the elevation of goat habitat would eliminate almost all risk from viewer activity disturbing the mountain goats or alienating them from their traditional habitat. Using goats as a Management Indicator Species, a similar situation should prevail for Dall sheep.

Dispersed recreation, whether motorized or nonmotorized, has the potential to disturb and displace some wildlife species Winter nonmotorized ROS classes have the largest amount proposed in Alternative D followed by No Action, C, E, B, F, A, and Preferred. For summer nonmotorized activities, ROS trends follow a similar pattern to that of winter with some slight variation; Alternative D has the most amount of land allocated followed by C, Preferred, A, E, F, and No Action

The effects of motorized use and road density on habitat effectiveness and big game hunting have been discussed earlier in this section. In addition, areas currently not managed for motorized access are viewed by some as areas in which motorized access may be warranted. However, many of these nonmotorized areas provide some of the last bit of solitude for many wide-ranging forest carnivores. Research on wolves in the eastern U.S. (Mech et al. 1988) has provided forest managers with some very important information related to road densities and subsequent human access. The result of increases in these activities and exceeding road density thresholds usually winds up in the loss of these species from the area. The alternative that emphasizes the most motorized access and subsequent increase in over-the-snow winter motorized ROS acreage, and has the greatest potential to disturb or displace wildlife species, is Alternative B, followed by C, D, Preferred, A, E, No Action, and F. For

summer, a slightly different picture emerges with the highest motorized ROS acreage going to Alternative C, followed by B, D, A, Preferred, E, No Action, and F.

Dispersed recreation activities such as Nordic skiing, snowboarding, heli-hiking, wildlife viewing or photography have grown in popularity over the last two decades. During certain times of the year wildlife can often be adversely affected by people using the winter habitat to view them or take photographs. The potential for stress to wildlife caused by dispersed recreation activities such as Nordic skiing, snowboarding, heli-hiking, wildlife viewing or photography is based on the projections to 2010 in total recreation visitor days of these activities by alternative. It would be greatest in Alternative A, followed by B, C, No Action, Preferred, D, E, and F.

Effects on wildlife from aircraft overflights

In general, wildlife responds to low-altitude (300-800 feet) aircraft overflights (USDI National Park Service 1994). The manner in which they do so depends upon life history characteristics of the species, characteristics of the aircraft, flight activities, and a variety of other variables and factors such as season, location, habitat type, species, and previous exposure to aircraft. Over 200 published and unpublished reports may be found on the subject. Review of the literature shows that aircraft overflights may cause flushing of birds from feeding or nesting areas, alteration of movement or activity patterns, decreased foraging efficiency, panic running of big game animals, decreased young survival, and increased heart rates in big game animals.

Of primary concern is the change in behavior or physiological responses to the overflights and the animals' fitness or ability to survive. Some researchers believe that low-elevation overflights can cause excessive arousal and alertness or stress (Fletcher 1980, Fletcher 1990). If chronic, stress can compromise the general health of animals. The way animals respond to overflights could interfere with raising young, habitat use, and physiological energy budgets. Physiological energy budgets have been repeatedly documented and would suggest that some of these consequences occur. While individual and group behavioral responses by animals to overflights are well documented for several species, few studies have addressed the long term or indirect consequences. Such consequences may or may not occur and may be detectable only through long term studies (USDI National Park Service 1994).

To evaluate the severity of impacts of overflights at the project level, the Chugach National Forest will use the criteria found in the 1994 Report to Congress Report on the effects of aircraft on the National Park System (USDI National Park Service 1994). These criteria are summarized below.

Negligible Effects

- No species of concern are present, no/minor impacts expected.
- Minor impacts that do occur have no secondary (long-term or population) effects.

Low Impacts

- Non-breeders of concern present in low numbers
- Habitat is not critical for survival; not limited to the area targeted for overflights, etc.
- No serious concerns expressed by state or federal fish and wildlife officials.

Moderate Impacts

- Breeding animals of concern are present/present for critical life stages.
- Mortality/interference with activities necessary for survival likely to occur occasionally.
- Mortality/interference are not expected to threaten the continued existence of species in the area.
- State and federal officials express some concern.

High Impacts

- Breeding animals present in high numbers and/or during critical life stages.
- Overflight areas have history of use during critical life stages during critical periods.
- Habitat is limited and animals cannot relocate to avoid impacts.
- Mortality or other effects (injury, physiological stress, effects on reproduction and young raising) are expected on a regular basis; these effects threaten the continued survival of the species.
- State or federal officials express serious concern.

Using this evaluation process relies on the professional opinions and best judgments of wildlife managers and researchers. The levels of impact listed here are used to “trigger” actions to eliminate or reduce such impacts. In general, the Forest Service regards situations consistent with “low impacts” to warrant monitoring, while situations that represent “moderate impacts” or “high impacts” would require some type of mitigation.

The two main species subject to effects from aircraft, particularly helicopter, overflights are mountain goats and Dall sheep. The wildlife standards and guidelines in the Revised Forest Plan are designed to ensure the viability of species and their habitats. The primary threat on the Chugach National Forest to the viability of mountain goat and Dall sheep winter and birthing habitat is acoustic disturbance. Absolute noise levels are not nearly as important as changes in the noise levels, and location and intensity (influenced by distance) of the noise has a direct effect on the behavioral and physiological responses of sheep and goats.

Mountain goat and sheep response to acoustic disturbance ranges from increased alertness with concomitant increases in pulse and respiratory rates and suspension of feeding activities, through walking or trotting away to avoid the disturbance, to fleeing at a gallop to escape the disturbance. Flight typically halts at steep terrain that, for goats, usually includes cliffs, where the animals halt and maintain their heightened alertness until the disturbance passes. Sever disturbance can cause disruption in sheep and goat social structure, abandonment of habitat or physical harm to individual sheep and goats while fleeing. Sheep, and to a lesser extent goats, habituate to some degree to consistent low-level acoustical disturbance, such as where a mineral lick or other attractive habitat is in proximity to a highway. Habituation is minimized where traffic speeds and noises are not constant, such as where steep hills require commercial trucks to change gears, use compression braking, or other actions that cause an abrupt change in the noise level. Mountain goat and sheep alert and escape responses tend to be less for disturbances that are lower in elevation than the animals, and especially when the disturbances are located close to existing disturbance points (highways).

Because mountain goat and sheep react faster and more intensely to perceived threats from above than from below their elevation, habituation to aerial disturbances is rare, and the problem seems to be exacerbated with helicopters. The rotor noise from helicopters is never constant. Large variation in noise intensity results from: changes in helicopter direction in response to local differences in air conditions; changes in rotor path, speed and angle associated with ascent and descent; and changes in tail rotor speed and position associated with helicopter attitude can all cause changes in loudness and apparent direction of the noise.

Many studies have documented detrimental, or potentially so, effects of helicopter noise and disturbance on ungulates, but few have focused specifically on mountain goats. All such studies have emphasized that little habituation occurs in ungulate species to helicopter noise, and mountain goats least of all (Joslin 1986). Of the paucity of studies on goats, none have been completed for mountain goats in Southcentral or Southeast Alaska. Of those completed in areas outside of Alaska, the effect on goats of helicopter use in relation to energy exploration (Cote 1996, Joslin 1986, Foster and Rahs 1985) was emphasized over that of helicopter use in a recreational setting (Hamilton et al. 1996). Helicopter disturbance reports for Dall sheep are sparse, but helicopter

disturbances of bighorn sheep are similar to those for mountain goats (Stockwell et al. 1991).

<u>No risk (≥ 1 mile)</u>

Cote (1996) suggested a 2 kilometer avoidance distance for helicopters from mountain goat habitat, but several factors in his study make his findings of limited applicability to the Chugach National Forest. Unlike Southcentral Alaska where escape terrain is plentiful for mountain goats that are mostly in low-density populations, Cote's study was done in an area with extremely limited escape cover on a population of goats at high density; and unlike the infrequent flights of recreational helicopters in Southcentral Alaska, his helicopters were flying multiple times every day and his sampling period was but a short span of the total time helicopters were active in his area. Cote (1996) visually estimated the distance of helicopters from the goats and placed the distance into one of three categories: < 500 meters, 500 - 1,500 meters, and > 1,500 meters. His was an observational, not an experimental study, so only 7 of 81 tabulated encounters (Cote 1996:683), or < 9 percent, were in the middle category. Of his tabulated total, two-thirds were > 1,500 meters from the helicopter disturbance. The vast majority of his total observations resulted in light to moderate disturbance of the goats, and by distance category about 14 percent at < 500 meters, about 43 percent at 500 - 1,500 meters, and about 91 percent at > 1,500 meters were all of light or moderate disturbance. Cote's (1996) recommendation of 2 kilometer can only be considered as a 'no risk' avoidance distance. Hamilton and others (1996) suggested a slightly more modest ¾ miles (1.2 kilometer) 'no risk' avoidance distance in the Sawtooth National Forest where security terrain is more readily available. Accordingly, an avoidance distance of ≥ 1 mile (1.6 kilometer) would have negligible effects on either individual goats or the viability of their populations on the Chugach National Forest.

<u>Low risk (≥ ½ mile)</u>

Interpolation of Cote's (1996) data suggests that 65 to 80 percent of the flights he observed would have resulted in a moderate or less goat reaction at ½ mile (800 meters). Because of the small number of flights from recreational helicopters in the Chugach National Forest, the lower density of mountain goats, their smaller absolute numbers, and the increased availability of security terrain, the actual number of encounters between helicopters at ½ mile or less and goats that react in a moderate or less manner would be small; less than the low estimate of 65 percent of flights in Cote's study. Foster and Rahs (1985) suggest a 2 kilometer lateral separation level of all aircraft based on data from their earlier work, but concede that a minimum flight altitude of 600 meters above ground level would eliminate the disturbance to goats in their Stikine River study area. Accordingly, the ≥ ½ mile avoidance distance must be considered to be at low risk of disturbance to individual goats, and at low-to-no risk of threatening mountain goat population viability in the areas of the Chugach National Forest where recreational helicopter use occurs.

<u>Low-to-moderate risk (> ¼ mile)</u>
As a part of their Forest Service permitted operations, Glacier Powder Guides is required to record and report wildlife sightings to the Glacier Ranger District. On March 21, 1998, their helicopter inadvertently landed and discharged skiers about 2,000 feet from a group of 6 goats, none of which exhibited any reaction to the helicopter or the skiers. Although this close approach to mountain goats is not in keeping with the mitigation measures listed in their permit, neither is it unexpected. Fox (1984) found that aerial surveys counted notably fewer goats than did ground-based surveys simply because of the difference in motion of the observers. The Glacier Powder Guides report supports the recommendations of Stockwell and others (1991, cited in USDA Forest Service 1997) that resulted in the 1,500-foot avoidance distance (> 400 meters) accepted by the Tongass National Forest as a mitigation measure against disturbance of goats (USDA Forest Service 1995c, 1997). The 1,500-foot avoidance distance was accepted by the State of Alaska reviewers of the Revised Supplemental Draft Tongass Land Management Plan.

Monitoring of the disturbance effects of helicopters on mountain goat in the Tongass National Forest has not revealed any adverse affect on individual goats, their populations, or their habitats. Of 76 observations of mountain goats in the Tongass National Forest in 1999, 78 percent were of no disturbance, two percent were of light disturbance, and one percent was of moderate disturbance. Of those 76 total observations 31 percent were < 500 meters from the helicopter, only one percent of the goats were moderately disturbed, and none were greatly disturbed (USDA Forest Service 1999f).

Although Cote (1996) suggested a 2 kilometer avoidance of all mountain goat herds, he conceded that an above ground avoidance distance of > 300 meters was necessary when helicopters must overfly goat habitat. A 1,500-foot avoidance distance (> ¼ mile) should therefore be considered to be at low-to-moderate risk of disturbance to individual goats, and at low risk of threatening mountain goat population viability in the areas of the Chugach National Forest where recreational helicopter use occurs.

It must be borne in mind that some adverse effects on goats and goat populations may be masked by other factors and may take years, perhaps decades, to be discernable (Joslin 1986), but no adverse effects from helicopter acoustic disturbances has yet been found in the Tongass National Forest (Iverson personal communication).

The Alternatives, F, E, D, the Preferred, the No Action, C, B, and A, would have, in decreasing order, potential effects from aircraft overflights, but standards and guidelines would greatly reduce or eliminate any effect under all alternatives.

Effects on wildlife from timber management
The effects of vegetation management, especially timber harvest, can be an immediate change in structure and often composition of the vegetation of the treated area. Timber management can have both positive and negative effects on wildlife habitats and their associated species.

In the place of decreased levels of historical disturbance agents such as fire and insects and diseases, timber management can provide a vegetation treatment that helps shape the diversity of habitats by rearranging vegetation composition, structure and pattern across the Forest. All alternatives allocate some land to be managed for personal use forest products. For commercial timber harvest Alternative A would provide for the most harvest followed by No Action Alternative and Alternative B.

Timber management and related road building activity could result in the loss of habitat effectiveness and wildlife disturbance and displacement (see discussion earlier in this section for disclosure of predicted effects by alternative). Cutting of dead spruce trees and snags for house logs and firewood could affect the availability of these important resources for cavities, for nesting and security, and for snag dependent species. Standards and guidelines are proposed under all alternatives that would require at least a minimum level of snags and downed woody material to be maintained.

Timber stand improvement activities have the potential to accelerate growth and vigor and thereby reduce the forest susceptibility to insect and disease infestations. However, certain treatments such as precommercial thinning, done for growth and volume, can have a negative effect on certain prey resources. Prey species such as the snowshoe hare can have portions of their habitat made unusable for periods of time following these treatments. Arrangement and intensity of these activities could be moderated to provide both the prey and product industry with sustainable products and habitats.

Timber harvest activities were projected to occur under favorable economic conditions. Harvest would occur within four watershed associations, and would have the effect of concentrating within the effects of the activities within these watershed associations. When considered over the entire Forest or geographic area, timber harvest at projected levels would have a very low likelihood of affecting the viability of any species for the following reasons. The total acreages to be harvested in the near term or over the planning period would not significantly change the structural stage distribution of the Forest beyond the expected range of variability at either the Forest or geographic scale. Forestwide standards and guidelines provide for maintaining fine-scale habitats within the timber harvest units and would be applied through environmental analysis at the project level.

In decreasing order, Alternative A, the No Action Alternative, and Alternative B would have the most potential effects from timber harvest, but standards and guidelines would greatly reduce or eliminate any effect under these alternatives. The remaining alternatives would have no effect.

Effects on wildlife from access management

Objectives for managing roads and trails are driven by the desires of the public and the managing agency mandates, which generally are spelled out in policy, directives or laws. Roads or trails can be used as tools to access land for commodity production, such as timber and minerals, or can serve as

transportation systems supplying people access to areas of unique scenic beauty or to dispersed or developed recreational sites.

The effects of roads on contiguous blocks of forest are well documented (Reed et al. 1996) and affect a wide variety of species. Roads can directly remove habitat affecting those species that have limited dispersal capabilities, or greatly reduce the amount of interior forest available for species that are interior habitat specialists. Roads also provide access to the public, which reduces effectiveness of surrounding habitats for many wildlife species. Big game species are discussed in more detail in a previous section of this chapter. The alternatives might affect wildlife, in decreasing order of potential effect, the No Action Alternative, Alternatives A, B, and C, the Preferred Alternative, and Alternatives D, F, and E.

Trails on the other hand have effects that are much harder to describe, but have been linked to disturbance and displacement of some wildlife species. Recent information (Canada Lynx Conservation Assessment and Strategy 2000) suggests that snow compaction from over-the-snow uses (motorized and nonmotorized) could lead to increased competition for lynx prey resources from coyotes. Increased trail mileage or increased use of trails by recreationists has the potential to increase the numbers of human-bear interactions, but any increase is anticipated to be minimal by the implementation of the Brown Bear Core Area Management Area and Forestwide standards and guidelines.

Appendix F displays how motorized access (highway vehicles, high clearance vehicles, off road vehicles, motorcycles, and snowmachines) and nonmotorized access (horses, hikers, skiers, bicycles, and dog sleds) would be managed under each alternative.

Effects on wildlife from transportation/utility corridors

Land corridors set aside for roads and utility access can disturb or displace wildlife species by changing the arrangement of forested and non-forested vegetation types across the Forest. Some prescriptions within alternatives limit or preclude the construction of transportation/utility corridors as a wildlife habitat conservation measure. In areas where contiguous forest habitats exist, these corridors break up these contiguous blocks with long linear landscapes comprised primarily of cleared or early seral vegetation components. Improper power line design can result in potential electrocution hazard for certain raptor species. Studies of collisions by swans, cranes, and other waterfowl with utility corridor powerlines have not been done in Alaska. In other areas, the proportion of non-hunting mortality on waterfowl can exceed 50 percent, although in the Canada and Pacific flyways it is < 14 percent. Of the overall waterfowl collisions, geese make up < 7 percent of the total, and swans < 1 percent (Stout and Cornwell 1976).

The arrangements of these corridors on the landscape have the potential to affect the dispersal capability of some species of wildlife. Access by humans and their associated recreational activities disrupts and displaces some wildlife. All alternatives provide the same acres of transportation/utility corridors.

Cumulative Effects

The cumulative effects are similar in all alternatives. Most of the activities with the potential to negatively affect wildlife resources are beyond the scope of the Revised Forest Plan and outside of Forest Service control. The cumulative effects for wildlife resources considers land within the Forest boundary and the private and BLM land between the three major divisions of the Forest.

Wildlife resources on the Chugach are generally in good condition. Past mining activities affected forest structure by creating large expanses of early seral forest stands due to repeated burning and commodity extraction. Many of these stands have recovered, again providing an abundance of mature forests, especially in hemlock and spruce-hemlock stands. Railroads that were built along many of the streams on the Forest have given way to high-volume roads and utility corridors. Two of the major highways on the Forest, the Sterling and Seward Highways, create movement barriers to some wildlife species (moose, bears, lynx, etc.).

Forest vegetation is not evenly distributed across the Forest, generally occurring in a pattern following the drainage and glaciations from the Chugach and Kenai mountain ranges. The Forest position on the landscape is a vital connection for wildlife movements to and from the Peninsula through the Portage-Placer-Twentymile valley connection. The Nellie Juan - Snow River connection is an important corridor for movement of wildlife and serves as a major connection between Prince William Sound and the Kenai Peninsula. The Copper River valley is an important landscape connection to the Interior.

Many of the low-lying valley bottoms along the forested corridor on the Kenai Peninsula are being influenced by the expansion of towns and supporting facilities. Expansion in these valleys, like that occurring near Moose Pass and Cooper Landing, is strongly influencing the movement pattern of many of the wide-ranging wildlife species. Development of private lands negatively affects the availability and quality of wildlife habitats.

Generally, private and state lands have higher road densities than those found on adjacent National Forest System lands. Public access and the effect it has on some wildlife species is becoming a focal issue at the federal and state levels. Managing wildlife resources across these mixed ownerships is becoming increasingly complex, and many of the solutions often must be dealt with cooperatively.

For species that are subject to hunting, trapping, or other directly consumptive use, state and federal regulatory mechanisms play an important role in the population dynamics of the species. Population and harvest objectives, controlled by lengths and types of harvest seasons affect the numbers and distribution of wildlife on the Forest.

The Kenai Peninsula has received some of the most significant human impacts in Alaska, to the detriment of some wildlife populations and habitat (Suring et at. 1998). The human population increased from 24,600 to 48,815 between 1977

and 1998 (U.S. Department of Commerce, Bureau of the Census 1999). Logging, mineral and energy development, and water impoundments occur on the Kenai Peninsula and modify or destroy wildlife habitat. Subdivision development, livestock grazing, recreation development, and sport hunting also occur on the Kenai Peninsula.

As communities on the Kenai Peninsula continue to expand, many of the important forested connections will be affected or lost. Maintaining options in future within these narrow bands of habitat will become a high priority for many wide-ranging species. The cumulative effects of increased development, recreation, tourism, and use of the Kenai Peninsula would affect all wildlife, and the coterie of carnivores from wolf and lynx through brown bears would be affected the most. These species are dependent upon mixed and seasonal habitats and upon prey species that are themselves subject to cumulative changes. Forest Service management and permitted actions will be conducted to minimize or eliminate any adverse effects on wildlife habitats consistent with human health and safety as specified in the alternatives and accompanying Revised Forest Plan, but the majority of development and activities on the Kenai Peninsula outside of the Chugach National Forest are not necessarily subject to such restrictions. Human activities will continue to influence wildlife habitat in various and unpredictable ways.

Because the majority of the Chugach National Forest will be free of management or permitted activities, few habitats would be modified outside of those changes that occur naturally. Effects of noise from potentially increased winter vehicle use and aircraft use are expected to be localized along trails and in alpine areas used for heli-skiing and heli-hiking. Helicopter activity in the alpine is typically of limited duration and occurs only on those days and in those areas where risks to human health and safety are not excessive. Accordingly, overall changes in the acoustical environment are anticipated to be negligible, but may be noticeable on a site-specific basis. Forestwide, the wildlife and associated habitat resources will remain within expected ranges of variability under current climatic conditions.

Uses and Designations of the Forest

Heritage Resources

Lands

Recreation and Tourism

Subsistence

Research Natural Areas

Roadless Areas

Access Management

Scenery

Wild and Scenic Rivers

Wilderness

Heritage Resources

Introduction

A series of federal laws mandate that the impact of federally funded or permitted activities on historic properties, also referred to here as heritage resources, and the protection of these properties, be considered prior to the initiation of management activities or undertakings. The value of historic properties on national forests are derived from the public's recognition, beginning early in the twentieth century, that these nonrenewable resources are important and should be protected. Through these laws, the public commemorates that past by recognizing specific places where activities and events occurred.

Legal and Administrative Framework

- Numerous laws, regulations and Forest Service policies direct the inventory, protection, restoration, and interpretation of heritage resources. These include the **National Historic Preservation Act**, the **National Environmental Policy Act**, the **National Forest Management Act,** the **Alaska Native Claims Settlement Act**, the **Archaeological Resources Protection Act**, the **Native American Graves Protection and Repatriation Act**, the **American Indian Religious Freedom Act**, **36 CFR 800**, **FSM 2300**, and **Programmatic Agreement #95-MOU-10-029** between the Alaska Region of the Forest Service, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer.

Key Indicators

- Number of acres inventoried
- Historic properties documented
- Historic properties monitored
- Number of historic properties located and evaluated for eligibility to the National Register of Historic Places
- Historic properties interpreted
- Historic properties preserved or protected

Resource Protection Measures

The National Historic Preservation Act (NHPA) protects historic properties. When an undertaking, as defined in 36 CFR 800, is begun, all historic properties are to be located and evaluated for their potential to be placed on the National Register of Historic Places. Those sites determined to be eligible for the Register are identified, whether pre- or post-European contact in age, as "historic properties." The State Historic Preservation Office (SHPO), Advisory Council on Historic Preservation (ACHP), Native Alaskan organizations and interested public

must be informed of potential effects to any historic property. Agreement on mitigation of effects to all historic properties must be reached through consultation with SHPO and the ACHP before any project may take place.

Affected Environment

Forestwide

The total extent of the heritage resource base on the Chugach National Forest is unknown, as only less than two percent of the Forest has been intensively surveyed. Two types of areas require more intensive historic properties inventory.

- Although the majority of the inventory on the Forest has taken place along the modern and historic road corridors and trail systems on the Kenai Peninsula and near Cordova and along the shoreline within Prince William Sound, there are still areas within ¼ mile of these much-used corridors and shorelines that have not yet been inventoried.
- Over 90 percent of Chugach National Forest lands are more than ¼ mile from trail systems, roads, or river and marine shorelines reachable by boat, and have not been inventoried for historic properties.

As of December 1999, heritage resource inventories have recorded 1,048 individual historic properties on the Forest. Most Forest heritage resource surveys were conducted for planned timber sales, mining plans of operation, recreation development, easements, and wildlife and fisheries projects. The historic properties survey of western Prince William Sound shorelines after the *Exxon Valdez* oil spill in 1989 resulted from an unplanned occurrence, and represents the Forest response to an unforeseen crisis.

Prehistoric/Native Alaskan Resources

Kenai Peninsula

The portion of the Chugach National Forest on the Kenai Peninsula includes both the inland Kenai River drainage, from the vicinity of the mouth of the Russian River upstream to the Kenai River headwaters and associated drainages, and the head of Turnagain Arm and associated watershed areas. This area has been used by Estuarine/Riverine-adapted people from early Holocene times to the present.

<u>Early to mid-Holocene (10,000 to 3,000 years ago)</u>

Although little is known about the settlement and subsistence patterns of the inhabitants of the Kenai Peninsula during this period, their presence is evidenced at sites near the Russian River, Quartz Creek, and Paradise Lake. Stone tool remains show a technological progression from core and blade industries to flaked stone industries with stemmed points, and shouldered knives. A lack of radiocarbon dates for these sites results in occupation ages being inferred by association with similar dated sites in other parts of southern Alaska (Reger 1998).

Riverine Kachemak (3,000 to 1,000 years ago)
The Kenai River basin was inhabited on a year-round basis by people related to marine-adapted groups of the Gulf of Alaska coast, beginning about 900 BC and continuing to about AD 1000. Reliance on netted salmon is believed to have been a major subsistence strategy of these residents. Both chipped and ground stone tools, and notched stones are common implements from this period. Houses were generally single semi-subterranean rooms with paved hearths (Reger 1998).

Late Prehistoric (1,000 to 225 years ago)
Numerous sites on the Kenai Peninsula date from the period between about AD 1000 and European contact in the eighteenth century. The technology of this period includes beaten copper implements, ground stone adzes, chisels and knives, and bone tools, including barbed points. Multi-roomed semi-subterranean houses with entry tunnels are common, associated with cache pits outside the house (Reger 1998).

Prince William Sound/Copper River Delta
Maritime-adapted people inhabited the islands and mainland shores of Prince William Sound and the Copper River Delta area for thousands of years.

Uqciuvit phase (4,000 to 2,500 years ago)
The earliest evidence of inhabitants in this part of the Forest is from two sites; one on the northwest mainland coast of the sound, and the other on Eleanor Island in the western part of the sound. Radiocarbon dates place inhabitants in this area about 4,000 years ago (Haggarty et al. 1991, Yarborough and Yarborough 1996, 1998, Yarborough 2000). Subsistence was marine oriented and technology included ground stone tools. The culture of the inhabitants bears similarities to the Ocean Bay culture phase of southern Cook Inlet and Kodiak, to the southwest. Although occupation at the mainland site appears to have been interrupted for about 700 years, possibly in association with an early Neoglacial ice advance, evidence from the site on Eleanor Island indicates continuation of habitation in other parts of Prince William Sound. Related geomorphological studies suggest that shorelines during this period of the Holocene and earlier, along which inhabitants would have lived, may be significantly different from today's shorelines.

Palugvik phase (2,500 to 1,000 years ago)
The culture of the inhabitants of the sound and north Gulf coast between about 2,500 years ago and 1,000 years ago was similar to the Kachemak phase evident in coastal communities to the west on Kodiak Island, around Cook Inlet, and along the Kenai River (Yarborough and Yarborough 1996, 1998). Cultural markers of this phase include semi-subterranean houses and a marked shift in the abundance of fire-cracked rock, but the small number of Uqciuvit phase artifacts makes technological distinctions between Uqciuvit and Palugvik phases difficult. Studies of archeofauna from this period indicate that both fish and marine mammals were important subsistence items (Yarborough 2000).

Chugach phase (1,000 to 225 years ago)
The artifact assemblages from sites of the late prehistoric period are characterized by the loss of some types of ground stone tools, the addition of copper implements, the use of quartz crystal gravers for fine wood-working, and a small resurgence in the use of chipped stone tools (Yarborough and Yarborough 1996). Prehistoric subsistence studies suggest that fish appear to have been equal to or more important than marine mammals during the Chugach phase (Yarborough 2000).

Kenai Peninsula/Prince William Sound/Copper River Delta
Historic period (AD 1778 to mid-twentieth century)
Although Vitus Bering landed on Kayak Island in the Copper River Delta area in 1741, no direct contact between Native Alaskans and Europeans occurred again in this region until the arrival of Captain James Cook in 1778. The years between 1771 and 1778 are generally known as the Protohistoric Period in this area, a time when both European trade goods and previously unknown devastating diseases arrived through established prehistoric trade routes, although there was no direct trade between Europeans and Alaska Natives. The historic era is recognized as beginning in most of the current Forest area in 1778 (Yarborough 2000).

At the time of European contact, Dena'ina Athapaskans occupied much of the northern and interior part of the Kenai Peninsula; Chugach Eskimos, also known as Alutiiq and Suqpiaq, occupied most of Prince William Sound; and Eyak Indians were moving into the Copper River Delta area (de Laguna 1956, 1975, 1990). Drastic population declines due to introduced disease, and cultural disruptions related to changed socio-economic and religious situations, are manifested in the physical record of historic settlements. Only intermittently occupied historic Dena'ina settlements are known from the upstream interior drainages of the Kenai River. In addition, some Prince William Sound/Copper River Delta settlements, such as Uqciuvit, Kniklik, Nuchek and Alaganik, were abandoned during the nineteenth and twentieth centuries AD. This resulted in consolidation of people into modern communities such as Tatitlek, Chenega, and Cordova.

Historic/Euro-American Resources – all areas of the Forest

The majority of historic properties on the Forest are directly related to Euro-American economic development of the area after European contact, rather than the cultural and geographic distinctions perceived prehistorically. Although many sites are settlements of one type or another, transportation routes are other recognized historic resources related to this development.

Russian Era (1741-1867) – Exploration/Maritime Trade
The early part of this era is characterized by exploration by variety of European navigators. By the end of the eighteenth century, the Russian American Company, a state monopoly, had consolidated its economic control over the territory of Alaska. During the following 67 years, economic development was oriented towards trade in furs of marine and terrestrial mammals (Cook and

Norris 1998). The Russian trading post of Fort Constantine was established on western Hinchinbrook Island in Prince William Sound, and the Kenai Redoubt was established at the mouth of the Kenai River (de Laguna 1956, Osgood 1976). A short-lived attempt was made to develop a commercial shipbuilding facility in the vicinity of the present-day city of Seward, and small-scale explorations of the mineral potential of the interior of the Kenai Peninsula were conducted, but these poorly organized and supported ventures bore no economic fruit (Cook and Norris 1998).

American Era – Expanded Commercial Resource Exploitation period

The United States purchased Alaska from Russia in 1867. The assets of the Russian American Company were sold to the firm of Hutchinson, Kohl and Company, which quickly merged with the Northern Commercial Company to form the American Commercial Company (ACC). Although other, smaller firms also pursued the fur trade in south central Alaska, the ACC quickly became the driving force of the continuing, but dwindling, fur trade, and the primary dry goods supplier for most residents. By the end of the nineteenth century and beginning of the twentieth century commercial fishing, whaling, fox farming, mining and logging had superceded fur trading as financially significant enterprises.

Commercial Fishing

By the late nineteenth century, fishermen using nets were supplying commercial salteries primarily with salmon. As the industry grew, canneries were established throughout the region to process larger amounts of fish, and the use of fish traps at stream mouths became common (Moser 1899, Porter 1893). The coastal remains of canneries, salteries, fish traps, and the homes of fishermen are the primary historic sites associated with this economic pursuit.

Commercial Whaling

Like the fur trade, commercial whaling was a relatively short-lived pursuit, commencing with exploitation during the Russian era, and continuing during the American era until depletion of the resource was so extreme in the early twentieth century that whaling became financially unprofitable. Although no whaling stations were established in Prince William Sound, at least one coastal shipwreck in the sound may be of a ship used in this trade (Haggarty et al. 1991).

Fox Farming

Dating to the introduction of foxes to the Aleutian Islands by Russians in the 1700s, the practice of fox farming on small islands continued into the twentieth century. Chugach Forest records identify permits issued beginning in 1909 and continuing as late as 1951. Isolated trapping, branding, and feeding stations are present on many islands, while a few complexes include not only these structures but also rearing pens, pelting sheds, docks, and residences (Haggarty et al. 1991).

Mining

Minerals prospecting on the Kenai Peninsula began in the Russian era, but resulted in no substantive discoveries. Prospectors entering Alaska after 1867 were part of a larger North American interest in mining. They were characterized

as men, and a few women, with "gold fever" but included some interested in silver, copper and other minerals. Part of an expanding industry with roots in the eastern U.S., prospectors and miners expanded west to the Rocky Mountains, then the Pacific coast of the United States, and then north into Canada and Alaska. Gold was discovered on the Kenai Peninsula in the vicinity of the Resurrection Valley in 1890. This led to an influx of over 10,000 people to the area by 1896, the development of the towns of Hope and Sunrise, and the establishment of Seward and what would become the Alaska Railroad. Significant gold deposits were found, claimed and worked between Turnagain Arm and Resurrection Bay, along the east side of the Kenai Peninsula. The discovery of copper deposits in Prince William Sound led to a similar rush, the development of large industrial complexes such as the Latouche Copper Mining Company on Latouche Island, the establishment of the city of Cordova, and the mining-related Copper and Northwest Railroad. The economic boom attracted not only miners, but also related service workers in a variety of professions and industries. Mining activities almost ceased with the advent of World War II. The physical legacy of mining on the Forest includes prospect test holes, cabins, roadhouses, trail networks such as the National Historic Iditarod Trail, and a variety of industrial mine sites in remote locations which have been identified for hazardous substance cleanup and safety hazard reductions (Mobley et al. 1990).

<u>Logging</u>
High quality commercial timber was rare on the Kenai Peninsula and in Prince William Sound. At the end of the nineteenth century, local trees were generally used for firewood, while commercial timber was brought in from the Pacific Northwest. Commercial logging began as an adjunct to the demands of the mining-related population, who needed timbers for mine supports and pilings, and wood for railroad ties. By 1925, the majority of timber used in Alaska was locally produced, rather than imported. Small mills were set up in Seward and Cordova. Demand increased with Civilian Conservation Corps work in the 1930s, and defense construction in the 1940s. Until 1949, contracts called for cutting 15,000 cords of pulpwood and 3.5 million board feet of saw timber annually on the Chugach Forest, usually by clear cutting. Evidence of this activity is most often seen in areas of clear-cut tree stumps found throughout the Forest.

Sites Eligible for the National Register of Historic Places

Two sites on the Forest are National Historic Landmarks and have greater protection status than National Register eligibility. These are Palugvik, a prehistoric Native village on Hawkins Island in southeast Prince William Sound, and the Bering Expedition Landing Site on Kayak Island, southeast of the Copper River Delta.

Several areas are recognized as having numerous significant historic properties in close proximity and have been designated Archaeological Districts. The Palugvik National Landmark is one site in the Palugvik Archaeological District. Another District recognized in Prince William Sound is the Rocky Bay

Archaeological District on Montague Island. Both Districts, along with a variety of other eligible sites, commemorate prehistoric Alutiiq culture.

The Sqilantnu Archaeological District encompasses a concentration of prehistoric and historic sites on the downstream portion of the Russian River, and adjacent areas upstream and downstream along the Kenai River. Types of sites in the District include Microblade culture, Kachemak culture, and prehistoric and historic Athapaskan culture sites, as well as evidence of historic gold miners' residences and activities.

Examples of sites on the National Register of Historic Places include the Cordova Post Office and Court House, owned by the Forest Service and used as the office of the Cordova District, the Bering River Steam Engine, the Chilkat Oil Refinery and the Million Dollar Bridge.

The Iditarod Trail has been recognized as a National Historic Trail and declared a Millennium Trail. Many secondary trails that connect with the Iditarod National Historic Trail, such as the Resurrection Pass Trail, are also considered eligible trails. Numerous individual sites associated with its use have been determined eligible for the National Register, among them the Bruhn Ray Mine, the Primrose Cabin and mine, the Mull Cabins, the Wible Mining Camp, and the Harry Johnson Cabin.

The designation "historic properties eligible for the National Register" includes both prehistoric and historic period sites across the Forest that qualify under at least one of four criteria listed in the National Historic Preservation Act, code of federal regulations. These are association or linkage to events (Criterion A) or persons (Criterion B) important in the past, significant for their design or construction value (Criterion C), or the ability to yield important information about prehistory or history (Criterion D). Most prehistoric sites on the Forest are eligible at least in part under Criterion D. Most historic sites are eligible under Criteria A, and/or B, and/or C. Many historic properties are eligible under two or more criteria.

Many eligible cultural and historic properties on the Forest have been selected by Alaska Native corporations for conveyance under Section 14(h)(1) of the Alaska Native Claims Settlement Act (ANCSA). To date, only eight have been conveyed.

Table 3-52 displays the heritage resource sites on the Chugach National Forest.

Table 3-52: Heritage resource sites on the Chugach National Forest, as of January 1, 2002.

Site Category	Number of sites
National Register of Historic Places	7
National Historic Landmarks	3
National Historic Trails	1
Sites Determined Eligible for the National Register	73
Sites Determined Ineligible	65
Other sites	574
Total (Known sites on the Chugach National Forest)	**723**

Environmental Consequences

General Effects

Unlike other resources such as vegetation or wildlife, heritage resources are not renewable. Damage or destruction is generally permanent. Although repairs may be possible in some cases, the historic nature of a resource is generally compromised once it has been impacted, and its eligibility for the National Register of Historic Places may be affected. Under all alternatives, the Heritage Program will continue to provide support to all of the resource projects, as required by Section 106 of the NHPA. This includes the evaluation and identification of appropriate sites for the National Register of Historic Places. In addition, the program would include inventory as required by section 110 of the NHPA, analysis, protection of significant heritage resources from vandalism and other negative human impacts, and from natural destruction. The Heritage Program staff will identify opportunities for interpretation of heritage resources for public enjoyment and education, using established programs such as Passport In Time, and working closely with the interpretive staff.

Management of heritage resources under Categories 4 and 5 prescriptions (see Chapter 2) may require more historic properties inventories than other prescription categories, and would emphasize protection and mitigation, including on-site interpretation for public education. These include activities such as forest restoration, mining, campground construction and trail construction. Although pedestrian surveys do not necessarily locate all heritage resources in a given area, this would potentially increase the knowledge of the historic properties on the Forest through an increased number of surveys. In the No Action Alternative, no acres are prescribed for Category 4 management, and only 0.23 percent of the Forest is prescribed for Category 5 management. The amount of acres managed in these categories is the same for Alternatives B, D, E, F, and the Preferred Alternative, with the implication that Heritage Resources in prescription areas falling under Category 5 for these alternatives would be managed in the same manner as at present. While the amount of land managed as Category 5 remains the same in Alternatives A and C, 10 percent of the Forest prescriptions are within Category 4 in Alternative A, and 5 percent in Alternative C. The effect of the increase in Category 4 managed lands in these two alternatives on

Heritage Resources would be an increase in the amount of inventory related to project activities and increased human use, with the expectation that additional Historic Properties would be discovered, evaluated, found eligible for the National Register of Historic Places, and subsequently interpreted for the public.

Prescriptions that fall under Categories 2 and 3 allow motorized travel and encourage a moderate amount of public recreation. Human use, although moderate, would have the added potential of both vandalism and unintended erosion effect on historic properties in less supervised situations. Maintenance and/or restoration of natural resources or ecological processes, and habitat manipulation, may impact historic properties. Mitigation of such manipulation, maintenance and restoration work would have only a small effect on the environment as perceived by the recreating public, and interpretation could occur primarily off-site. Over 69 percent of the Forest acreage in the no Action Alternative has Category 2 or 3 prescriptions. This compares to just over 53 percent in the Preferred Alternative, about 90 percent in Alternative A, 83 percent in Alternative B, 74 percent in Alternative C, 52 percent in Alternative D, 32 percent in Alternative E and 18 percent in Alternative F. Because over half the Forest is proposed to be managed under prescriptions in Categories 2 and 3 in the No Action and Preferred Alternatives, and Alternatives A through D, project-related work in these alternatives may result in a large number of both acres surveyed and resources located. Heritage Program work completed in the process of implementing laws relating to such projects would result in expansion of knowledge regarding these resources. It would also improve the database available for developing models to predict Historic property locations.

In areas designated for Category 1 prescriptions, few management-driven projects would be expected, and would therefore have little effect on cultural resources. Although land travel would be nonmotorized, human use may be moderate, as a result of possible increases in unregulated motorized boat access via the Whittier Road and Prince William Sound. The location of many cultural resources coincides with boat landing sites throughout the sound, and some well-known sites are actually recreation destinations. As with Categories 2 and 3, there would be a potential for vandalism and unintended erosion of or effect on cultural resources in minimally supervised situations. Because few individuals are expected to use these areas, site vandalism may occur and remain unnoticed for long periods of time. Historic structures, buried cultural resources, and cave and rock shelter sites would appear in their natural states. The percent of Forest acres on which historic properties would be managed under Category 1 prescriptions varies widely, from less than 1 percent in Alternative A, about 17 percent in Alternative B, and 26 percent in Alternative C, 43 percent in the Preferred Alternative to almost 50 percent in Alternative D, about 69 percent in Alternative E and over 81 percent in Alternative F. The No Action Alternative places about a third of the Forest in Category 1 prescriptions. Site inventory and condition documentation, with yearly monitoring by Forest Service staff, would be the major heritage resource activities for this category, in addition to any project support. As with historic properties in Categories 2 and 3, on-site interpretation could, and would most likely, occur primarily off-site.

Direct and Indirect Effects

Effects from Facilities Maintenance – Several of the facilities currently in use on the Forest are historic properties. The maintenance, reconstruction, remodeling, and removal of these properties are considered to be a direct effect to the property. In all prescriptions and alternatives, these activities would be conducted in compliance with the NHPA.

Effects from Fire Protection – Wildland fire poses direct threats to historic structures and features such as corduroy roads, and indirect threats to prehistoric sites whose buried artifacts may be thermally altered by intense heat. The suppression of wildland fires has the potential to affect historic properties if control activities directly disturb historic properties. In all prescriptions and alternatives, activities that reduce fuel loads, such as prescribed burns and salvage sales, are projects that require mitigation measures to comply with the NHPA.

Effects from Wildlife and Fisheries – Impacts from wildlife and fish habitat management activities are generally limited to the project level. These projects include, but are not limited to, prescribed burns, revegetation, and stream fish structures. Effects that might occur to historic properties would be mitigated in compliance with the NHPA in all prescriptions and alternatives.

Effects from Land Exchanges – Exchanges of federal land for private land has the potential to affect cultural resources. The legal protection for historic properties ends once the land ownership becomes private. In all prescriptions, this direct effect must be mitigated in compliance with the NHPA, before the land exchange takes place. Conversely, land that is acquired by the federal government is protected by all the laws, which normally apply to federally maintained lands. Such property should be inventoried for cultural resources and managed appropriately according to the Revised Forest Plan subsequent to its acquisition.

Effects from Easements and Utility Corridors – The construction activities for utility developments and the establishment of various types of easements have the potential to both directly and indirectly affect historic properties. In all alternatives, these direct and indirect effects will be mitigated in compliance with the NHPA. One indirect effect is the potential for vandalism of a site or theft of artifacts during the execution of projects. Another indirect effect is making access available to the public to previously inaccessible areas.

Effects from Recreation - The construction of recreation facilities, such as campgrounds, trails, roads, toilets, and parking areas, has the potential to directly affect cultural resources. In all prescription categories, these direct effects will be mitigated before the initiation of construction. Both positive and negative effects can indirectly result from recreational management. Negative impacts include vandalism of sites and theft of artifacts, inadvertent camping directly on sites, and soil erosion. Some of the positive effects are the edification and education of the public about heritage resources, which in turn provides public support for preservation and interpretation. Construction of new trails or roads into areas,

which previously had little public access, and improvement of existing trails and roads creates an indirect effect to cultural resources as it opens new areas to recreational activities and increases the potential for disturbance. Very little of such construction is planned under the Preferred Alternative, so little additional effect is expected to cultural resources from such activities.

Access to cultural sites by motorized vehicles or boats, however, seems to increase the probability of damage to a site. Impacts to cultural resources in the form of vandalism and theft of artifacts are generally the greatest within ¼ mile of areas of motorized use. Prescription Categories 2 and 3 provide motorized access to sites, and Categories 4 and 5 place a high emphasis on motorized recreation, and would therefore have greater indirect impacts on cultural resource sites. In addition, although Category 1 prescriptions do not allow motorized road or trail access, a substantial portion of Forest lands in this category are easily accessed by boat, via the Whittier Road. As a result, cultural resources within ¼ mile of the shore of the sound would be subject to the same indirect effects as those areas accessible by roads and trails in other parts of the Forest.

The effect of organized recreation through outfitter/guides can be both positive and negative. If outfitter/guides are educated regarding cultural resource protection laws and are required to provide such information to their clients prior to guided trips, they would be able to assist the Forest in its cultural resource protection responsibilities. If not, they may directly or indirectly impact cultural resources by inadvertently disturbing cultural resources of which they have no knowledge.

Effects from Wilderness Management – A wilderness prescription reduces the amount of potential damage to heritage resources from management activities. If the management of wilderness requires the removal of buildings that are historic properties, this direct effect would be mitigated prior to their removal. Currently, most cultural resource inventories are conducted in areas where ground-disturbing projects are proposed. In areas that are managed as wilderness, there would be fewer ground-disturbing projects.

Effects from Timber Management – Alternatives A, B, and No Action would have larger, commercial timber sales. Heavy machinery used to build roads and harvest trees would have the potential to directly affect cultural resources. However, even in smaller scale timber projects, such as for fuel management, the actual harvesting has the potential to directly affect cultural resources. Archaeological sites are threatened by the disturbance of the soil. Direct effects would be mitigated in compliance with the NHPA in all alternatives.

Effects from Mineral and Energy Development – Pertaining mainly to prescriptions in Category 5, the use of heavy machinery in the construction and access to energy and mineral extraction areas, as well as the actual extractive activities themselves, are direct effects, which would be mitigated in compliance with the NHPA. Many current claims are on or in the vicinity of historic mining remains, some of which have been determined eligible for the National Register

of Historic Places. Many of the mines identified for safety hazard cleanup have already been determined eligible for the National Register of Historic Places, and such a determination is likely for others. Indirect effects of both development and cleanup work include the potential for vandalism of a site or theft of artifacts during the execution of the project, and the increased potential for vandalism and theft due to new public access. The result of such projects would be the assessment, consideration, and mitigation of both indirect and direct effects on cultural resources.

Cumulative Effects

In general, the Preferred Alternative would represent little change from the No Action Alternative in regards to the effect of management on heritage resources. Motorized access would decrease in some areas, possibly decreasing the impact of the public on cultural resources. Alternatives A and C would likely have the greatest effect on the management of heritage resources because of their inclusion of lands with Category 4 as well as Category 5 prescriptions. The opening of the Whittier Road is expected to increase public access to Forest lands managed under prescriptions in Categories 1-3 in all alternatives. While not a result of Forest management activities, the potential increase in public access to and impact on heritage resources in Prince William Sound needs to be monitored and addressed in the management of these areas.

The laws protecting cultural resources apply to federal lands, and federal undertakings, as defined in the NHPA. While undertakings occur primarily on public lands, some may occur on privately owned lands where the Forest Service has easements, or can occur in situations where the Forest, or another federal agency, is funding or permitting a project or activity. The benefit to the public is that Forest compliance with Section 106 of NHPA on all prescriptions will provide information about and protection for significant cultural resources, while similar information and protection may be absent for sites on privately owned lands.

Lands

Introduction

This section addresses management of landownership and special uses, such as electronic sites, utility corridors, and roads.

Legal and Administrative Framework

- The **Organic Act**, **Forest Land Policy and Management Act**, **Alaska National Interest Lands Conservation Act (ANILCA)**, **Alaska Native Claims Settlement Act (ANCSA)** and numerous other laws provide the framework for land use authorizations and ownership adjustments.

Key Indicators

- Acres of transportation/utility corridors and electronic sites

Resource Protection Measures

Lands are consolidated for improved management efficiency, to reduce property boundary lines, to eliminate management problems, to provide public access, and protect specific resources. Land acquisitions are evaluated for resource protection/acquisition, restoration support and administrative benefits provided through changes in land ownership. Appraisals determine purchase price for acquisitions and identify if any inequalities of land values must be corrected to enable completion of land exchanges.

Public requests to develop or expand commercial land use opportunities must be in compliance with all pertinent laws and Revised Forest Plan direction before the request is accepted for consideration.

Affected Environment

Land Ownership

The Chugach National Forest was created by presidential proclamation in 1909. The number of acres of public land administered by the Chugach National Forest has undergone several major changes. ANILCA established the present boundaries including the Copper River addition, the College Fiord addition, and the Two Indian deletion. Approximately 90 percent of Native and state land entitlements have been conveyed. *Exxon Valdez* oil spill land acquisitions have resulted in the acquisition of 102,790 acres in fee simple interest and conservation easements interests. Land and resource data acquired since land conveyance is being used to identify areas for potential ownership adjustments to consolidate resource protection and management and public activities.

The United States acquired land interest as part of the *Exxon Valdez* oil spill (EVOS) restoration process, some of which were acquired in the Forest. Acquisitions have been based on the offers of willing sellers. Priorities for action are determined through resource evaluation and identification of benefits to oil

spill recovery. This established process would guide all future EVOS funded acquisitions and may assist in evaluating opportunities outside the spill area.

Through the EVOS land acquisition process, over 120 private land parcels have been identified with potential benefits for acquisition. The National Forest System lands historically administered by the Chugach National Forest on Afognak Island have been selected and are going through the conveyance process. The need for land exchanges is increasing as private land developers address difficult access issues to private lands. Table 3-53 shows the current land status for the Chugach National Forest.

Table 3-53: Chugach National Forest land status (acres), as of January 1, 2002.

National Forest System	5,391,240
Acquired National Forest	102,790
State of Alaska	383,890
Native Corporations	418,500
Private	16,460
Net National Forest	5,494,030
Gross	6,312,880

Source: Chugach National Forest GIS corporate database.
Please note that the net acres is slightly different (+0.02 percent) than what was used in the Forest Plan revision analysis. The Forest acres are continually changing as lands are acquired and disposed of.

Special Uses

Special use permits allow occupancy or use of or rights and privileges on National Forest System lands. In many rural locations, Alaska's infrastructure is largely undeveloped. The 1984 Forest Plan identified that there was a full range of occupancies that are authorized through special use permits, easements and memoranda of understanding. Since 1985 the special use administration workload has increased by approximately five percent per year.

Currently the Forest administers 253 permits consisting of 42 cabins or residences; 80 outfitter guides; 42 industrial camps; 2 hatcheries; 11 power lines and FERC-related activities; 15 electronic sites; 11 roads, and 40 minerals materials permits. Memoranda of Understanding and Agreements include military training exercises, interagency management of lands, resource investigations, and management and navigation aids for boats and planes.

Environmental Consequences

General Effects

The Revised Forest Plan determines management allocations, which may influence land acquisition or disposal priorities, and direct where and how special land uses for personal or commercial activities may occur. Land ownership may be adjusted to: 1) meet identified reserve management needs; 2) reduce administration problems and cost, and further enhance public use; and, dispose of land better suited for non-federal ownership. The implementation of the Revised Forest Plan will place lands under management direction such as establishing limits or guidelines for developing access to private property,

developing communication systems and establish parameters for commercial development or recreational operations.

Land Ownership Effects
Land ownership is not directly impacted by the implementation of the Revised Forest Plan.

Land adjustment activities are expected to increase in volume as private landowners seek opportunities to dispose of properties and federal and private land managers discover benefits of consolidating land ownership. These activities will be influenced by the Bureau of Land Management completing land conveyances under Alaska Statehood Act, Alaska Native Claims Settlement Act, Alaska National Interest Lands Conservation Act and the Chugach Natives Incorporation Settlement Agreement of 1982. The Revised Forest Plan standards and guidelines will direct how efforts to resolve complicated resource management through land ownership adjustment.

Special Uses Effects
The tourism and outfitter/guide industry is increasing at a rate of about 12 percent per year (Brooks and Haynes in press). Many popular recreational sites have reached the desired capacity for visitation and commercial operators are seeking new areas to operate. Tourism industry efforts to provide accommodations for visitors are creating new uses such as floating lodges.

Under all alternatives, the expected growth of tourism of 8-12 percent per year will create an increase in demand for commercial uses of public lands and the development of private lands with supporting uses such as access, water, and power from public lands.

Technology improvements in fields of communication, especially cellular phones and fiber optics, and the growing visitation to remote sites are developing increased demand for use of public lands for repeater facilities. The Memorandum of Understanding with the State of Alaska on tide and submerged lands and coastal zone management has generated a need for increased coordination and cooperation with state agencies. Private landowners desire access to inholdings for commercial purposes. Increased populations and industrial growth in rural areas is creating higher demands for electrical power, and power companies are upgrading and modifying power lines and access routes. A mari-culture industry is becoming established in Prince William Sound, generating requests for utilization of public lands to support farming operations.

Alternatives for managing special uses range from maximizing development opportunities to maximizing wilderness management. Alternatives maximizing development provide the greatest opportunity for special use activities and would have fewer constraints on developing access and public services. As alternatives shift to wilderness management the opportunities for development decrease and constraints on uses increase. Examples of increasing constraints as wilderness values increase include limiting group size for operators in wilderness, requiring special design features, or requiring screening and extra effort required to blend developments into the wilderness setting.

Management Prescription Effects

The Transportation/Utility System/Electronic Sites Management Area would be managed for existing and future transportation systems, utility systems and electronic sites. These systems are defined as state and federal highways, hydroelectric dams, reservoirs, power generation sites, railroads, railroad spurs, powerlines, electronic sites, pipelines 10 inches or greater in diameter, and the two potential access routes identified in the Chugach Natives Incorporated Settlement Agreement (1982) to the Bering River coalfields. This management area prescription does not apply to Forest development roads or to roads that access private in-holdings.

All alternatives, including the Preferred Alternative, would mange 5,900 acres for major transportation/utility systems, electronic and communication sites.

Recreation and Tourism

Introduction

In 1899, E. J. Harriman invited the country's leading natural scientists on a voyage to Alaska. Traveling 9,000 miles from Seattle to the Bering Sea, naturalists such as John Muir, William Dall, Louis Agassiz Fuertes, and B. E. Fernow recorded their observations of Alaska's wildlife and fish, Native peoples, natural resources, and geography. Henry Gannett, Chief Geographer of the U.S. Geological Survey, concluded his chapter for the twelve-volume report of the Harriman Expedition with the following observation (Burroughs et al. 1901):

> There is one other asset of the Territory not yet enumerated, imponderable, and difficult to appraise, yet one of the chief assets of Alaska, if not the greatest. This is the scenery. Its grandeur is more valuable than the gold or the fish or the timber, for it will never be exhausted. This value, measured by direct returns in money received from tourists, will be enormous; measured by health and pleasure it will be incalculable.

Recreation and tourism is how people directly experience the spectacular natural scenery of the Chugach National Forest. Rugged mountain ranges with slopes and glaciers that tumble to the sea; fish runs so abundant that any angler can catch a big one; watchable wildlife such as brown bears, moose, bald eagles, whales, and sea otters; seabird concentrations that may be unrivaled anywhere else north of the Everglades; and, old growth temperate rainforest scattered on a string of islands and coastal lands--all make the Chugach National Forest an outstanding recreational setting for people seeking health and pleasure.

Yet the very features that make the Chugach National Forest so outstanding may also limit recreational opportunities. Much of the Forest is covered with steep mountains, glaciers, icefields, or icy-cold saltwater. People must have well-developed outdoor adventure skills such as backcountry skiing, sea kayaking, and mountaineering, or use modern technology such as snowmachines, helicopters, and motorized boats to access this rugged, remote, and often unforgiving terrain. Frequently a combination of both approaches is needed to fully enjoy the Chugach National Forest.

As a result, mainstream recreational opportunities on the Chugach National Forest are concentrated along the few road corridors and shorelines that people can easily reach. Crowding and some conflicts among recreationists are increasing in such areas. Tourists and residents may look to the private sector for the technical skills and support they need to access less crowded backcountry areas. Such businesses can serve to increase the availability of remote areas to the public. Construction of new recreation facilities such as trails and campgrounds can also increase the range of areas easily accessible for mainstream recreationists. Yet whether new opportunities are provided through tourism businesses or additional facilities, the central dilemma of balancing access and the land's capacity remains--how do we continue providing high

quality recreation opportunities in a way that conserves the Forest's unique natural landscape for future generations?

Public input to this planning process has identified Recreation and Tourism as one of the six situations central to revising the Forest Plan. The main components of the Recreation/Tourism Situation are: 1) people's desire for a variety of recreation settings and opportunities; 2) the desire for either additional or fewer facilities than today's levels: and 3) competition for access to National Forest System lands among recreationists pursuing different activities, particularly motorized and nonmotorized winter activities.

Legal and Administrative Framework

- The **Organic Act of 1897** instructs the Secretary of Agriculture to preserve and regulate occupancy and use of the national forest.
- The **Multiple-Use Sustained Yield Act of 1960** expands the purposes for which national forests were established, which include outdoor recreation, range, timber, watershed, wildlife, and fish.
- The **Wilderness Act of 1964** established the National Wilderness Preservation System, consisting of federal lands designated, among other purposes, to preserve their "primeval character and influence."
- The **National Trails System Act of 1968** established a national system of recreation, scenic, and historic trails, in "order to provide for the ever-increasing outdoor recreation needs of an expanding population."
- The **National Forest Management Act of 1976 (NFMA)** established the forest planning process, with regulations stating that forest plans will provide "for the safe use and enjoyment of the forest resources by the public."
- The **Wild and Scenic Rivers Act of 1968** established a system to preserve rivers with "outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values."
- The **Forest and Rangeland Renewable Resources Act of 1974** directs the Secretary of Agriculture to periodically assess the forest and rangeland resources of the nation, and to submit to Congress, at regular intervals, recommendations for long-range Forest Service programs essential to meet future resource needs.
- The **Land and Water Conservation Fund Act of 1964** "assists in preserving, developing, and assuring accessibility to all citizens of the United States of America…such quality and quantity of outdoor recreation resources as may be available and are necessary and desirable…by…providing funds for the federal acquisition and

development of certain lands and other areas." The Act also provides for the collection of daily recreation use fees for each federal agency developing, administering, providing or furnishing, at federal expense, specialized outdoor recreation sites, facilities, equipment, or services.

- The **Alaska National Interest Lands Conservation Act of 1980 (ANILCA)** includes a variety of provisions with direct or indirect implications for recreation management on national forests such as access, traditional activities in wilderness, taking of fish and wildlife, establishment of the Nellie Juan-College Fiord Wilderness Study Area, etc.
- **Forest Service Manual 2300** contains Forest Service Policies for recreation management.

Key Indicators for Recreation Settings

- Difference among existing and proposed Recreation Opportunity Spectrum (ROS) classes, by alternative
- Comparison of relative distribution of ROS classes, among alternatives

Key Indicators for Accommodating Recreation Use

- Comparison among existing developed infrastructure and capacity and the alternatives' proposed developed infrastructure and capacity
- Comparison among existing dispersed recreation capacity and the alternatives' proposed dispersed recreation capacity

Key Indicators for Responding to User Group Conflicts

- Comparison of strategies used by alternatives to respond to user group conflicts, in each geographic area (Kenai Peninsula, Prince William Sound, Copper River Delta)

Affected Environment

The Affected Environment describing the current situation for Recreation and Tourism on the Chugach National Forest is divided into two major parts. The first displays and discusses the existing situation with respect to recreation activities, recreation infrastructure, recreation settings and capacity, commercial services, and interests and situations for the three geographic areas of the Chugach National Forest. This part provides the reader with a snapshot of the nature and quantity of recreation occurring on the Forest and may be thought of as presenting the current supply side of recreation and tourism. It is organized under the following topic areas:

Key Concepts:

- Definitions
- Information Sources

Existing Recreation Situation By Geographic Area:

- Types of Activities
- Infrastructure and Capacity
- Range of Inventoried Settings and Capacity
- Interests and Situations

The second is an in depth presentation and discussion of past, present, and projected participation in recreation activities at the national, state, and local levels. This part sets the stage for the assumptions and methodology that is used to project recreation use on the Chugach National Forest to the year 2010. This part may be thought of as presenting the future *demand* side of recreation and tourism on the Chugach National Forest:

Projections of Recreation Use:

- Information Sources for Participation and Use Projections
- National Recreation Use and Projections
- Alaskan Recreation Use and Projections—Alaskan Residents
- Alaskan Recreation Use and Projections—Alaska Visitors
- Chugach National Forest Recreation Use
- Summary of Recreation Patterns
- Projections of Visits for the Chugach National Forest

Following this section on the Affected Environment, the Environmental Consequences of the alternatives are analyzed using the concepts, data, and projections presented in the Affected Environment.

Key Concepts

In setting the stage for the Affected Environment and Environmental Consequences, several key concepts used by Forest Service managers of recreation and tourism need to be defined. These concepts are components of the key indicators listed in the previous section. After the concepts are defined, sources of information about them for the Chugach National Forest are described.

Recreation Settings

The goal of most recreationists is to have a positive experience by engaging in outdoor recreation activities. Forest managers cannot provide recreation experiences, but they can provide the settings for these experiences to be realized. Recreation settings in this context are the physical places in which a variety of recreation activities occur. Participating in activities in appropriate settings creates a user's recreation experience and consequent level of satisfaction (USDA Forest Service 1986). Matching one's desired experience

with a setting that can allow the realization of that experience is the key to a satisfactory, positive recreation experience.

Settings are described by defining the attributes that people can expect to find at a particular location. Knowing the attributes characteristic of a given setting assists people in matching their desires to appropriate settings. For example, individuals seeking solitude, challenge, and remoteness will seek settings that are distant, inaccessible, and undeveloped. In contrast, a person desiring easy access, comfort, and opportunities to interact with many other people will seek convenient highly used settings that provide modern facilities.

The Forest Service utilizes a system, called the Recreation Opportunity Spectrum (ROS), to describe different settings across the Forest. The ROS can be used in two ways for recreation planning: (1) it can be used to inventory recreation settings that currently exist on the Forest, sometimes referred to as "inventoried ROS" or "existing condition ROS", and (2) it can be used to describe management direction for the future, also referred to as "proposed ROS". The ROS system describes settings as classes with specific, defined attributes. The ROS classes range from highly modified and developed places to primitive, undeveloped settings. Attributes typically considered in describing the settings are scenic quality; type and degree of access; remoteness; level of development; social encounters; and the amount of on-site management (USDA Forest Service 1986, also referred to as the "ROS Book"). Table 3-54 is a matrix that displays these attributes for the ROS classes found on the Chugach National Forest.

Table 3-54: Description of ROS classes on the Chugach National Forest.

ROS Element	Rural (R)	Roaded Modified (RM)	Roaded Natural (RN)	Semi-primitive Motorized (SPM)
Scenic Quality	Alterations to landscape character may dominate; activities do not exceed moderate SIO in Fg, Low SIO in Mg	Alterations to landscape character dominate; activities & structures evident, but do not exceed low SIO.	Alterations to landscape character subordinate; activities do not exceed low SIO	Alterations to landscape character few & subordinate; activities and structures designed and located to not exceed moderate SIO.
Access	All methods of access and travel may occur, but subject to formal regulation.	All methods of access and travel when needed and compatible with intended activities	All methods of access and travel may occur, when compatible with intended activities; zones of nonmotorized use.	Travel on trails designed for or open to motor vehicles. Roads maintained for high clearance vehicles. Motorboats operate on water. Zones of non-motorized use may be established to protect facilities or resources.
Remoteness	Remoteness from sites and sounds of human activity not available or important.	Remoteness from continuous sounds of human activity is expected.	Remoteness from continuous sounds of human activity is of moderate importance.	Nearby sights and sounds of human activity are rare. Distant sounds may be heard.
Visitor Management	On-site regimentation and control is obvious.	On-site regimentation and control is obvious.	On-site regimentation and controls are few.	On-site regimentation and controls are few.
On-site Recreation Development	Recreation structures and facilities readily evident, but appropriate for setting, designed for high use levels. Information and interpretive facilities may be large and complex.	Recreation structures and facilities provided for site protection and user convenience. Facilities are contemporary but of rustic design and harmonize with natural setting.	Recreation structures and facilities may be present, but are provided primarily for protection of the resource rather than user convenience. Facilities are rustic and harmonize with a backcountry setting.	Recreation structures and facilities may be present, provided primarily for protection of site rather than user convenience. Facilities are rustic and harmonize with natural setting.
Social Encounters	Moderate to high concentrations of people at one time.	Interactions with others may be moderate to high. Moderate concentrations of people, especially on trails and in dispersed areas.	Moderate concentration of users on roads and little evidence of others or interactions at campsites.	Low interaction between users. Campsites seldom within sight or sound of another group except during peak periods.
Visitor Impacts	Very noticeable but managed to prevent physical resource degradation.	Use noticeable, but not degrading resources. Site hardening dominates campsites and parking areas.	Use noticeable but not degrading to resources or established SIOs.	Use noticeable but not degrading to resources or backcountry setting.
Chugach National Forest Example	Begich, Boggs Visitor Center	None at this time	Seward Highway, Copper River Highway	Scott Glacier drainage

SIO = Scenic Integrity Objective; Fg = Foreground Mg = Middleground.

Table 3-54 (continued): Description of ROS classes on the Chugach National Forest.

Semi-primitive Groups (SPG)	Semi-primitive Nonmotorized (SPNM)	Primitive II (PII)	Primitive I (PI)	ROS Element
Alterations to landscape character in Fg dominate, surrounding area natural appearing	Alterations few and subordinate to landscape character; activities and structures designed to meet high SIO.	Alterations to landscape character not evident. Few structures are present		Scenic Quality
Primarily nonmotorized, access by boat, plane or trail	Trails closed to motorized use. Nonmotorized boats used on freshwater lakes and streams.	Motorized use for traditional activities and subsistence only. Generally nonmotorized off trails or water bodies, primitive trails	Nonmotorized, primitive trails	Access
Remote from other sites, but on-site sounds of human activity present	Nearby sounds of human activity are rare. Distant sounds may be heard.	None or very infrequent sounds of human activity.	None or very infrequent sounds of human activity.	Remoteness
On-site regimentation and control is obvious.	On-site regimentation and controls are rare.	On-site regimentation and controls are very rare.	On-site regimentation and controls are very rare.	Visitor Management
Recreation structures and facilities may be present, provided primarily for protection of site rather than user convenience. Facilities are rustic and harmonize with natural setting.	Recreation structures and facilities may be present but provided primarily for protection of site rather than user convenience. Facilities are rustic and harmonize with natural setting.	Recreation structures and facilities rarely present, provided primarily for protection of site rather than user convenience. Facilities of native material and harmonize with natural setting.	Recreation structures and facilities rarely present, provided primarily for protection of site rather than user convenience. Facilities of native material and harmonize with natural setting.	On-site Recreation Development
Moderate to high concentrations of people at one time, typically large groups for short periods of time	Low interaction between users. Campsites seldom within sight or sound of another group except during peak periods.	Very low interaction between users. No other groups in sight or sound of overnight camps.	Very low interaction between users. No other groups in sight or sound of overnight camps.	Social Encounters
Very noticeable but managed to prevent physical resource degradation.	Human use noticeable but not degrading to resources.	Human use essentially unnoticeable. Site hardening—boardwalks, boat moorings, food caches may be present.	Human use essentially unnoticeable. Site hardening—boardwalks, boat moorings, food caches may be present	Visitor Impacts
None at this time	Johnson Pass Trail	Eastern Copper River Delta	Unakwik Inlet, Icy Bay	Chugach NF Example

SIO = Scenic Integrity Objective; Fg = Foreground Mg = Middleground.

Recreation Capacity

Recreation capacity is an estimate of the number of people that could occupy the Chugach National Forest at one time within the limits of the recreation settings (USDA Forest Service 1986). The number of people at one time, referred to as people-at-one-time (PAOT), varies by the mix of settings and the number of developed facilities on the Forest. Recreation capacity may be thought of as the supply of recreation opportunities available on the Forest.

Alternatives for management can change the Forest's supply of recreation opportunities in several ways. For example, assigning more of the Forest to ROS classes at the Rural end of the spectrum would increase total capacity, whereas more area in Primitive classes decreases the total capacity. Capacity can also be increased by constructing additional developed facilities designed for higher densities of people. A detailed discussion of ROS settings and capacities is located later in this section.

Recreation Activities

Recreation activities are what people do to create their recreation experience. Driving for pleasure, viewing scenery, watching fish and wildlife, and winter sports are recreation activities that are particularly popular on the Chugach National Forest. Recreation activities and the settings in which they occur are inseparable. People venturing out to recreate on the Forest may participate in several different activities in one or more settings on any given trip, or they may find their desired opportunity in a single setting.

For example, a family may go camping in their RV to a developed campground and enjoy visiting with other campers, cooking dinner over a campfire, and exploring nature in the campground. They are finding multiple activities in a single setting. Another family may also camp in the same campground, but decides to take a hike to fish in an alpine lake. The campground is in a Roaded Natural setting, while the hiking trail traverses Roaded Natural and Semi-primitive Nonmotorized settings before ending at the lake in a Primitive setting. The second family is participating in multiple activities in a variety of settings.

Suitability of Lands and Waters for Recreation Activities

Suitability of lands and waters for recreation activities relates to the capability of the land or waters to support a given recreation activity or setting. All acres of the Forest are not created equal when it comes to suitability for a given recreation activity. For example, a backpacker looking for a place to pitch a tent will avoid steep hillsides, wet muskegs, and alder thickets. It may be that in a 100-acre area, only 80 acres are actually suitable for primitive camping. Suitability of land for specific activities is evaluated in concert with establishing capacities for various settings.

Recreation Use

Recreation use is a measure of the number of people participating in a given activity or using a given site. Use is measured in a variety of ways by recreation managers and researchers. Researchers often measure the percentage of a population that participates in an activity at least once a year. This type of

recreation participation is evaluated in depth under “Projections of Recreation Use”. Forest Service recreation managers typically measure recreation use in one of two ways: as a recreation visit or as a recreation visitor day. Recreation visits is the measure that is used in this analysis.

The following definition was used in the collection of the use data on the Forest in 1998. A recreation visit is one person visiting a site or participating in a recreation activity on a given day. How long they stay at a site or participate in an activity is not measured. One person may generate several visits in a day if they go to multiple places in a day or participate in more than one activity in a day. For example, a person might take a scenic drive along Turnagain Arm to visit the Begich, Boggs Visitor Center on Portage Lake, then go for a hike on Portage Pass Trail, and finish the day by paddling a kayak to the kittiwake rookery across from Whittier. The Forest Service would measure this person’s day of recreation as one visit for “driving for pleasure”; one visit for “viewing scenery”; one visit for “learning at a visitor center”, one visit for “hiking”, and one visit for “sea kayaking”. This single individual has generated a total of five visits in one day to the Chugach National Forest.

As part of the analysis of recreation supply and demand, use levels are projected into the future to provide an estimate of future demand. Future demand can then be compared to each alternative’s proposed recreation capacity or supply. The methodologies used to measure current use and project use into the future are described in detail in “Projections of Recreation Use”.

Special Use Permits

Recreating on many areas of the Chugach National Forest require excellent outdoor skills and/or specialized equipment. Some people may not have the requisite skills or equipment yet still desire to participate in a particular activity or to visit a remote area of the Forest. Where such services are needed or desired, commercial outfitters and guides are present to assist people and enhance their recreation experience. Outfitter and guides operating on the Forest are required to have a special use permit authorizing them to provide commercial services to the public.

The Forest Service authorizes commercial activities via special use permits to facilitate the public’s participation in recreation activities; to provide services that add value to a recreation activity; and to help maintain recreation settings by distributing recreationists into underutilized settings. Types of services provided by outfitter/guides on the Chugach National Forest include big game hunting, whitewater rafting, llama packing, dog sled rides, and a wide variety of other recreation activities. Equivalent terms used in this FEIS or the Revised Forest Plan for special use permits include commercial operations, commercial services, and special use permits.

Group Size

Group size refers to the total number of people traveling together. As an attribute of recreation settings, the number and type of social interactions with people other than one’s own group significantly affects the quality of one’s recreation

experience. Maintaining the attributes of settings is key to meeting recreationists' expectations.

For example, the opportunity to meet new people and participate with them in recreation activities is a major attraction of RV camping for many people. For the social campers, a developed setting with many other people, including large groups, provides a quality recreation experience. Conversely, backpacking often attracts people looking to get away from it all. For such backpackers, a little used trail that leads to an isolated lake with no one else for miles around provides the optimal recreation opportunity.

Accordingly, the Forest Service manages the attributes of settings to ensure that people's expectations are met for all ROS classes. Providing facilities that accommodate and promote large gatherings would be consistent with settings on the Rural end of the spectrum. In Primitive and Semi-primitive ROS classes, managers would take actions to keep use at levels appropriate for remote settings, such as limiting the number of Special Use Permits for rafting a river or designing trails that promote small group travel.

Information Sources for Recreation Settings, Capacity, and Use

Three primary information sources are used for data regarding recreation settings, capacity, and use levels on the Chugach National Forest. This data is used to describe the existing situation or baseline conditions. The data is then used in the analysis of the alternatives and the changes that are projected to occur under each alternative.

<u>Recreation Settings</u>

In 1998, the Forest Service inventoried all lands within the Chugach National Forest boundary using the principles and methods in the ROS Book (USDA Forest Service 1986). This document is generally considered to be the authoritative approach to identifying and mapping recreation settings, and is widely used throughout the Forest Service. USGS quads were used as the base for the ROS inventory mapping, which was then entered into the Forest's Geographic Information System (GIS). The definitions and mapping of the ROS classes were reviewed by staff from all three Ranger Districts who were knowledgeable about their Districts and the ROS classes. This process for inventorying ROS classes results in a reliable display of existing recreation settings on the Chugach National Forest. The mapping is intended to provide a broad layout of settings and is not applicable at a site-specific level. Site-specific anomalies may occur within a given recreation setting. This validated map of ROS classes across the Forest is the inventoried ROS. The inventoried ROS classes are the baseline against which the proposed distribution of ROS classes under each alternative is compared.

<u>Recreation Capacity</u>

Recreation capacity is divided into two categories: developed capacity and dispersed capacity. Developed capacity includes the capacities of constructed recreation facilities such as cabins, campgrounds, visitor centers, day-use areas,

and other developed sites. Dispersed capacity is the capacity of undeveloped areas as determined by the recreation setting.

Recreation capacity is measured in two ways: people-at-one-time (PAOT) or people-at-one-time-days (PAOT-days). PAOTs provide a “snapshot” in time of the number of people that could occupy a developed site or an undeveloped area at one time (as defined by the recreation setting). A PAOT provides no information about how long a person stays at a site or area, nor does it consider the activities people may engage in at the site or area.

PAOT-days represent the capacity of a site or area for its season of use. It is a management tool that integrates the physical capacity of a site or area, with the season of use. PAOT-days for a site/area are calculated by multiplying the site/area’s capacity in PAOTs by the number of days that the site/area is open to use.

Determining the total developed capacity for the Chugach National Forest is straightforward. For example, a campsite in a developed campground has a capacity of 5 PAOTs. The campground is open for 110 days. The PAOT-days for the campsite are: 5 PAOTs times 110 days equals 550 PAOT-days. If there are 100 campsites in the campground, the total capacity of the campground is 55,000 PAOT-days. The sum of the seasonal capacities for all developed sites on the Forest is the total developed recreation capacity.

Calculating the capacities of dispersed areas is not as straightforward. Capacity in undeveloped areas is directly related to the recreation setting and expectations users have for a given setting. For visitors, these expectations are often based on tourism marketing efforts that promote Alaska as vast wildlands with no people (Colt et al. in press). While there is much truth to that image, many “wild” areas have more people using them than many visitors expect.

Capacities for these undeveloped dispersed areas are based on methodology provided in the ROS Book (USDA Forest Service 1986). The ROS Book provides a range for numbers of people per acre for each setting, referred to as capacity coefficients. This range of capacity coefficients was developed in Colorado. Given people’s expectations as to the character of lands in Alaska, we used the lower end of this range for establishing the capacities of Primitive and Semi-primitive settings on the Chugach National Forest, where providing a relatively greater degree of “wild” character is desired. A capacity midway in the range is used for Roaded and Rural settings on the Forest where higher concentrations of people are consistent with a lesser degree of “wild” character.

Capacity coefficients are expressed as number of people per acre. Multiplying the coefficient by the total acres in an area results in "people at one time" for that area. The capacity coefficients used for calculating dispersed area capacities on the Chugach National Forest are as follows:

Primitive and Primitive II	Semi-primitive, Nonmotorized or Motorized	Semi-primitive Groups	Roaded Natural	Roaded Modified	Rural
0.002	0.008	100[1]	1.3	1.3	4.2

[1] For areas in the Semi-primitive, Groups ROS class, the total number of PAOTs is displayed.

Note: Total PAOTs rather than a capacity coefficient are displayed for the ROS class named Semi-primitive Groups. This ROS class is unique to the Chugach National Forest; therefore, no coefficients have been developed for it. The existing Semi-primitive ROS classes provide settings that are characterized by a low number of people and few developments. A recreation experience that tourism providers are marketing are visits to an essentially wild setting as part of a group of up to 100 people. The Semi-primitive Groups class was developed during the planning process in response to this emerging form of tourism. It is used at selected sites in several alternatives and is included in developing capacity estimates for alternatives. The Semi-primitive Groups ROS class is intended to be no more than 50 acres in size, and is more fully described in Table 3-54.

Although the Chugach National Forest encompasses about 5½ million acres, much of this large land area is functionally unusable by most people because of remoteness, steepness, impenetrable vegetation, or expense of access. Calculating capacities without taking into account the suitability of the land for recreation would result in unrealistically high capacities. To reflect a reasonable capacity on the Forest, a model was developed to identify only those areas that are usable by a majority of recreationists. The assumptions used in developing the model are as follows:

- Recreation use is concentrated along and within ½ mile of roads, trails, water routes, and within one mile of cabins.
- Recreation users have a preference for alpine settings and water bodies and will travel further than ½ mile in order to reach highly desirable locations.
- Recreation users will generally avoid areas with dense, almost impenetrable vegetation such as alder thickets.
- In Prince William Sound, users seldom travel higher than the 200-foot elevation.
- Recreation users do not venture on to steep terrain and glaciers.

With GIS technology, these assumptions were applied to the Chugach National Forest land base, creating a map that displays suitable areas across the Forest by their existing ROS setting. The model is used to show varying capacities by alternative.

Recreation Use

For the purposes of displaying existing use levels occurring at Forest recreation facilities and dispersed areas, data from the Forest Service's Infrastructure (INFRA) database was used (USDA Forest Service 1998c). The most recent data available is from 1998 and is used in projecting future use. Prior to INFRA, a system known as Recreation Information Management (RIM) was used. RIM data is available for 1989 to 1996. However, starting in 1996, there were significant changes in data collection and computation methods for dispersed activities. Because new definitions and methodologies were used after 1996, the RIM and INFRA data sets cannot be used together to develop information about trends in dispersed recreation use over time. Although, the use data for fee sites, such as campgrounds and cabins, are based on actual counts allowing the data to be compared over many years.

Nationally, the Forest Service has begun collecting recreation use information in a completely new way. The new system, known as the National Visitor Use Monitoring project, is a sampling approach that will generate forest-level use information with a statistically defined level of accuracy. The Chugach National Forest began implementing this new system in 2001, so no data is yet available for use in this analysis.

The collection of recreation and tourism use data is not an exact science. Except for locations where fees are collected or where people can be counted cost efficiently, most of the use data is based on long-term observations, anecdotal information, and professional estimates, adjusted with quantitative indicators where available. Consequently, use data for developed facilities, such as campgrounds, cabins, and visitor centers, based on actual counts of visitors, is very reliable. Data for activities such as sightseeing is partially inferred from traffic counts, with somewhat greater potential for error. The most difficult type of use to enumerate is backcountry use. Estimates are based on sources such as trail counters and trail registers, which quantifies only a portion of the total use. In summary, only certain activities or sites have new data collected every year. All other use data is updated annually from the previous year's data using information on changes in statewide or regional tourism levels, indexed with the new data recorded in those areas actually counted each year, and by observations from field personnel or anecdotal information from knowledgeable individuals (Colt et al. in press).

Existing Recreation Situation by Geographic Area

In this section, the existing recreation situation for each of the three major geographic areas of the Chugach National Forest is described: Kenai Peninsula, Prince William Sound, and Copper River Delta. For each area, the description includes the general character of the area; types of recreation activities

occurring; the available recreation facilities and their capacities; the range of inventoried settings and their capacities; commercial recreation activities and opportunities; and, a summary of important Recreation/Tourism Interests and Situations.

Kenai Peninsula

Character

The Kenai Peninsula (the Kenai) offers a classic "Alaskan" experience reasonably accessible to large numbers of people. Every year, hundreds of thousands of residents and tourists are attracted to the Kenai Peninsula by its grand scenery, opportunities for viewing fish and wildlife, a multitude of recreation activities available along its trails, roads and at developed facilities, and world class sportfishing.

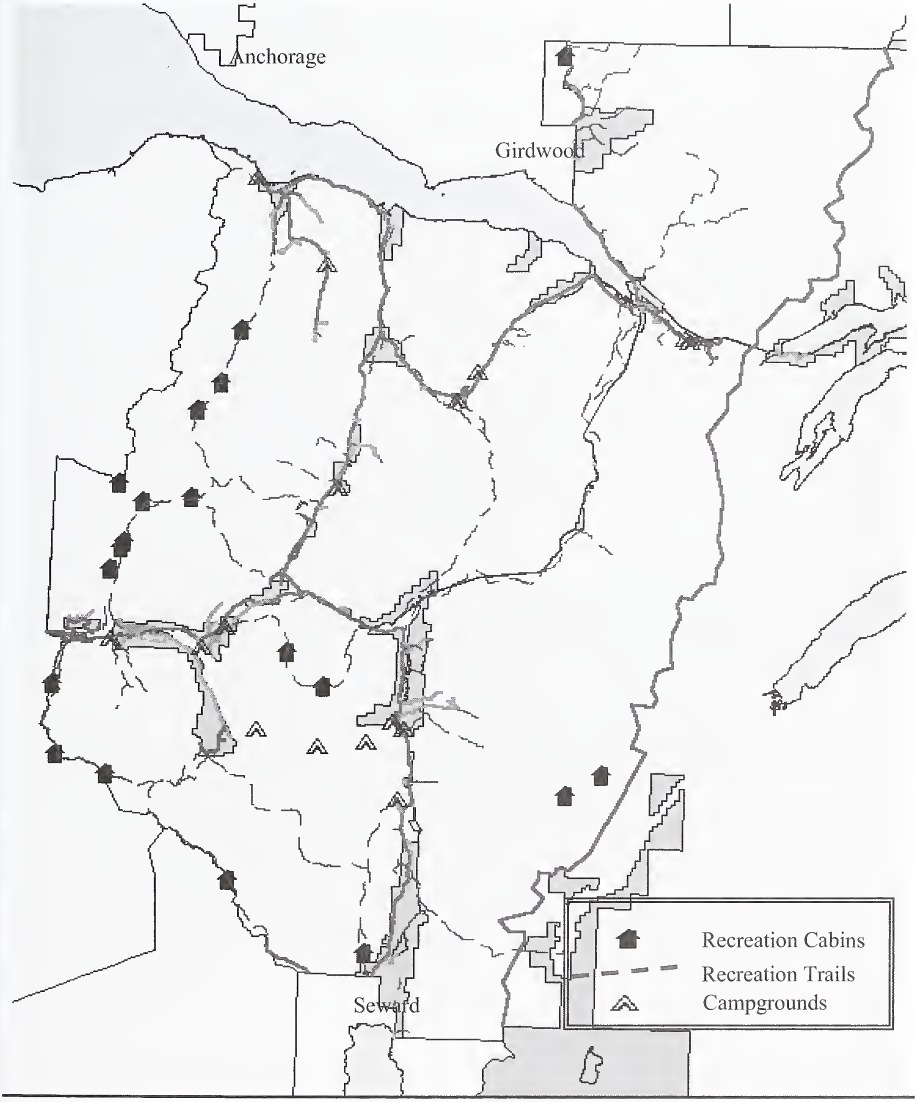
Compared to the Forest's other two geographic areas, the Kenai Peninsula has a substantial infrastructure. Almost all of the major valleys have a road, trail, or railroad. The Seward Highway, the only road south from Anchorage, winds through the heart of the eastern Peninsula. It was recently designated one of the nation's few All-American Roads in recognition of its outstanding scenic quality, historic significance, and recreation opportunities. The Sterling Highway branches off the Seward Highway and provides access to Cooper Landing and beyond. A variety of recreation facilities are concentrated along the road system (Figure 3-53).

The overall character of the eastern Kenai Peninsula is essentially wild. The steep mountains, rivers and glaciers, and a relatively small road and trail system for the size of the land base limit access to many undeveloped backcountry areas. The result is concentrated use in valley bottoms or along corridors where access is available and recreation facilities are located. Recreation settings range from areas of major development and high concentrations of people along the road and trail corridors, to remote, undeveloped areas in the backcountry with little use and no development.

Recreation activities on the Kenai Peninsula are the most diverse of any of the geographic areas. In the summer, the most popular activities are sightseeing, including driving for pleasure, going to Begich, Boggs Visitor Center, viewing fish and wildlife, fishing, camping, and hiking. In the winter, snowmachining and cross-country skiing are the most popular activities.

Because the infrastructure concentrates recreation use on a relatively small part of the land base, major conflicts over access have developed between winter motorized and nonmotorized uses and activities. In the summer, when overall recreation use is higher, this same limited road and trail system has resulted in a concentration of users at developed sites (mainly cabins and campgrounds). The result is use at sites exceeding the capacity for which they were designed.

Figure 3-53: Kenai Peninsula geographic area.



Types of Activities

People participate in a diverse number of activities year-round. Sightseeing, visiting centers such as the Begich, Boggs Visitor Center, and viewing wildlife and fish are by far the most popular year-round activities. In the summer, fishing, hiking and camping, in descending order, are the next most popular. In winter, snowmachining and cross-country skiing are most popular. Table 3-55a displays total annual visits to the Forest for recreation activities on the Kenai Peninsula in 1998.

Table 3-55a: Recreation visits by activity - Kenai Peninsula.

Recreation Activity	Total Visits Developed Sites	Total Visits Dispersed Areas	Total Visits Kenai Peninsula
Sightseeing	341,278	2,719,142	3,060,419
Visitor center, nature education	1,219,651	26,262	1,245,913
Wildlife/fish Viewing	163,459	409,487	572,946
Fishing	22,865	350,960	373,825
Hiking	29,094	326,550	355,644
Cross-country skiing	137,529	52,438	189,967
Primitive camping	0	161,983	161,983
Snowmachining	121,182	38,612	159,794
Developed camping	121,033	0	121,033
Picnicking	4,510	71,353	75,863
OHV, ATV, 4WD	69	37,047	37,116
Berry picking	2,800	32,657	35,457
Backpacking	0	33,687	33,687
Hunting	4,094	12,943	17,037
Biking	2,317	9,558	11,875
Canoe/raft/floating	39	5,135	5,174
Cabins	3,957	0	3,957
Motorboating	118	3,394	3,512
Climbing	0	1,055	1,055
Other	166,296	77,070	243,366
Total	**2,340,290**	**4,369,333**	**6,709,623**

Source: USDA Forest Service 1998 INFRA database (USDA Forest Service 1998c).

Existing Infrastructure and Capacity

The Kenai Peninsula has several state highways, numerous hiking trails, all of the Forest Service's developed campgrounds, and 19 of the Forest's recreation cabins. Except for recreation cabins, developed faciiities are located along the road corridor. There are 415 developed campsites for tents, RVs or trailers; 17 day-use sites, including the most visited place in Alaska, Portage Glacier and the Begich, Boggs Visitor Center; and, 345 miles of trails, of which 80 percent are open to winter motorized use. The developed recreation infrastructure and capacity for the Kenai Peninsula is shown in Table 3-55b.

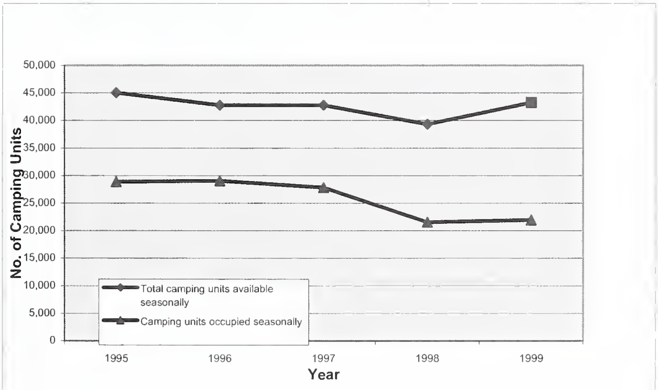
Table 3-55b: Developed recreation infrastructure and capacity - Kenai Peninsula.

	Facility Types					
Measures of Capacity and Use	Campgrounds	Cabins	Day Use Sites	Trailheads	All Trails	Winter Motorized Trails
PAOT-days	577,297	43,380	549,719	44,272		
No. of facilities	14	19	17	18		
No. of camping units	415					
No. of camping units or cabin nights available during season	44,172	5,844				
No. of camping units or cabin nights occupied during season	22,948	2,136				
No. of trails					64	n/a
Miles of trails					362	267

Source: USDA Forest Service 1998 INFRA database (USDA Forest Service 1998c), Cabin reservation reports (2000), Campground use reports (2000).

A review of records provided by the campground concessionaire show that from Memorial Day to Labor Day, campgrounds are at or near 100 percent occupancy, with use falling off significantly before Memorial Day and after Labor Day. Over the season, campground occupancy ranges from 40 to 60 percent (Figure 3-53a). Generally accepted management practices for recreation facilities consider a 60 percent occupancy average to be the maximum for a facility.

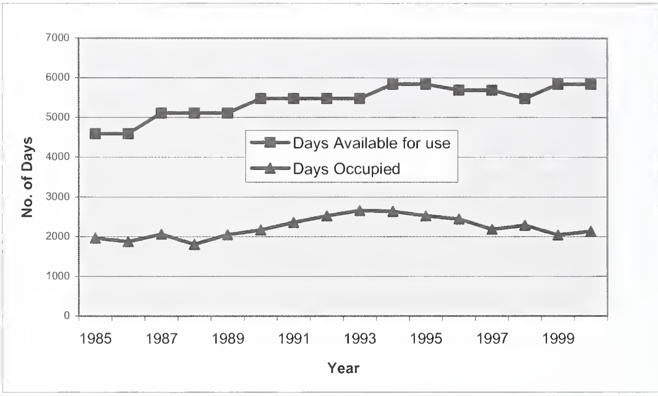
Figure 3-53a: Campground occupancy - Kenai Peninsula.



Source: Campground Concessionaire Use reports.

Recreation cabins along the Resurrection Pass and the Barber Cabin are typically fully reserved from Memorial Day to Labor Day. Other cabins on the Kenai Peninsula are only slightly less full. Spot checks of the cabin reservation calendars in May 2001 showed that only scattered days were still available for reserving in the months of June, July and August. The annual occupancy rate for Kenai Peninsula cabins is about 40 to 50 percent. Cabins are available for rental year round, but occupancy rates are calculated based on the season of actual use. Although most cabins are nearly 100 percent occupied during the three summer months, cabins receive some shoulder season (spring and fall) and winter use, accounting for a lower annual occupancy rate.

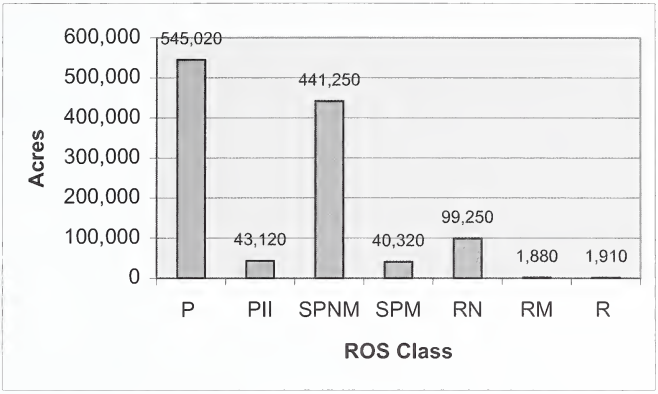
Figure 3-53b: Cabin occupancy - Kenai Peninsula



Range of Inventoried Settings and Capacity.

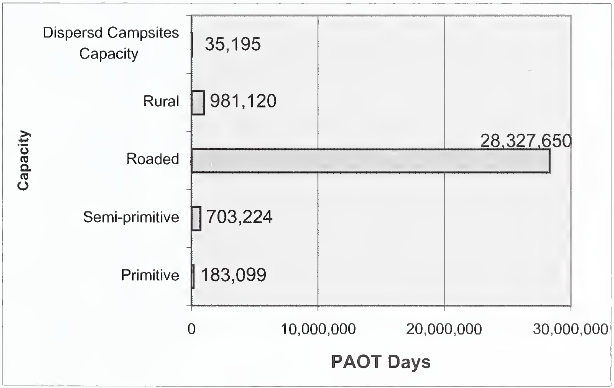
The entire spectrum of recreation settings available on the Chugach National Forest can be found on the Kenai Peninsula, Figure 3-53c. Along the road corridors, the Roaded Natural ROS class is consistent with the relatively high use and development level found along the road system. A Rural ROS class occurs at Portage Glacier and the Begich, Boggs Visitor Center due to the very high levels of use and multi-million dollar facilities at that location. There are no areas on the Chugach National Forest that meet the definition of Urban ROS class.

Figure 3-53c: Inventoried ROS classes – Kenai Peninsula.



As displayed in Figure 3-53d the overall dispersed recreation capacity is 30,313,013 PAOT-days, based on the Kenai Peninsula's season of 365 days.

Figure 3-53d: Recreation capacities of dispersed areas – Kenai Peninsula.



Interests and Situations

The Kenai Peninsula is located within an hour's drive of half Alaska's population and two-thirds of visitors to Alaska. The accessibility and large numbers of people wanting to recreate on the Kenai Peninsula have led to the most intense conflicts among users and interests on the Chugach National Forest:

- motorized and nonmotorized winter recreation opportunities, including snowmachining, heli-skiing, cross-country skiing, and natural quiet;
- concentrations of people at developed recreation sites, especially campgrounds and cabins, exceeding available capacity; and,
- need for additional recreational access, for both winter and summer activities.

Prince William Sound

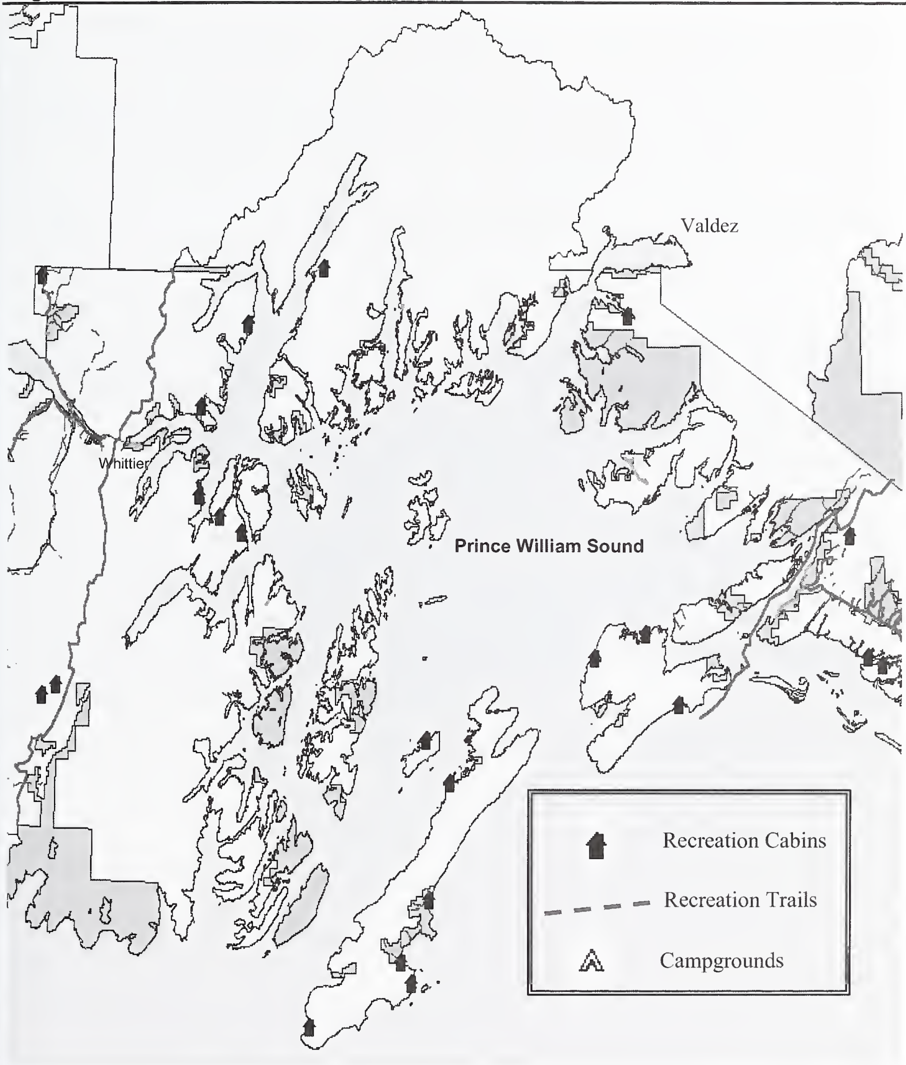
Character

Prince William Sound, one of the largest saltwater sounds in the world, is a land of spectacular scenery (See Figure 3-54). With the Chugach Mountains providing a backdrop of perennially snow covered 13,000-foot peaks, the narrow fiords and tidewater glaciers, old growth forests and alpine tundra, create breath-taking scenery. On land can be found black bear, brown bear, mountain goats, Sitka black tailed deer, nesting shorebirds, and haul outs for Stellar sea lions. In the marine waters swim Orcas, humpback whales, Dall porpoises, sea lions, harbor seals, and all five species of Pacific salmon. Wild and remote with no roads and access only by watercraft, floatplane or helicopter, recreation settings are primarily undeveloped and dispersed. All activities are strongly marine oriented, with the Chugach National Forest providing the backdrop for both water and land based activities.

Access to Prince William Sound is primarily from the water, with recreation use concentrated along the shorelines primarily during the summer months. Whittier is the most popular point of access given its proximity to Anchorage, followed by Valdez and Cordova on the eastern side of the Sound.

The western half of Prince William Sound is the congressionally designated Nellie Juan-College Fiord Wilderness Study Area (ANILCA, Section 702). Specific direction is to maintain the existing wilderness character until Congress acts on permanent Wilderness designation or releases the area from Wilderness Study.

Figure 3-54: Prince William Sound geographic area.



Types of Activities

Not surprisingly given the Sound's spectacular scenery and world class wildlife, sightseeing and watching or photographing wildlife are the two top activities in the summer. Large, ocean-going cruise ships and smaller day cruise boats provide a high percentage of the scenery and wildlife viewing opportunities. A modest visitor center located in Valdez generates a substantial amount of visitation, due to its location on the Richardson Highway and good salmon viewing on site. At significantly lower levels are activities such as hiking, fishing, and hunting, as well as kayaking (tallied under "backpacking" in Table 3-55c).

Table 3-55c: Recreation visits by activity - Prince William Sound.

Recreation Activity	Total Visits Developed Sites	Total Visits Dispersed Areas	Total Visits Prince William Sound
Sightseeing	2,443	543,340	545,783
Visitor center, nature education	173,177	0	173,177
Wildlife/fish Viewing	70,980	150,072	221,052
Fishing	181	19,248	19,429
Hiking	0	22,273	22,273
Cross-country skiing	0	153	153
Primitive camping	0	900	900
Snowmachining	0	0	0
Developed camping	0	0	0
Picnicking	0	10,823	10,823
OHV, ATV, 4WD	0	0	0
Berry picking	34	11,216	11,250
Backpacking	0	6,728	6,728
Hunting	247	5,484	5,730
Biking	0	0	0
Canoe/raft/floating	184	403	586
Cabins	845	0	845
Motorboating	945	0	945
Climbing	0	197	197
Other	10	14,084	14,094
Total	**249,044**	**784,920**	**1,033,964**

Source: USDA Forest Service 1998 INFRA database (USDA Forest Service 1998c).

Existing Infrastructure and Capacity

The Prince William Sound geographic area has a very limited infrastructure on the Forest, consisting of a few short, primitive hiking trails, no developed campgrounds, and 16 of the Forest's recreation cabins (Table 3-55d).

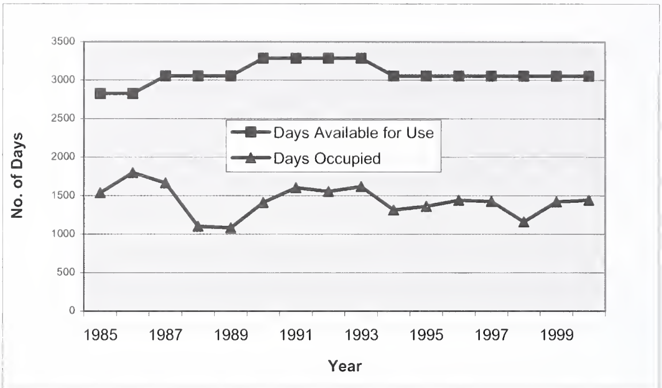
Table 3-55d: Developed recreation infrastructure and capacity – Prince William Sound.

Measures of Capacity and Use	Facility Types					
	Campgrounds	Cabins	Day Use Sites	Trailheads	All Trails	Winter Motorized Trails
PAOT-days	0	33,766	11,900	0		
No. of facilities	0	16	1	0		
No. of camping units	0					
No. of camping units or cabin nights available during season	0	3,288				
No. of camping units or cabin nights occupied during season	0	1,444				
No. of trails					40	0
Miles of trails					88	0

Source: USDA Forest Service 1998 INFRA database (USDA Forest Service 1998c), Cabin reservation reports (2000), Campground use reports (2000).

Recreation cabins near Whittier are typically reserved well in advance from Memorial Day to Labor Day. Other Prince William Sound cabins are generally less full except for specific periods associated with a salmon run or hunting season. Figure 3-54a shows occupancy at 40 to 50 percent for the entire year. Checks of the cabin reservation calendars in May 2001 show that only scattered days are available for renting cabins in western Prince William Sound during the months of June, July and August.

Figure 3-54a: Cabin occupancy – Prince William Sound.



There are no developed campgrounds in Prince William Sound, but there are over 300 user-developed dispersed campsites. Despite this large number of camping sites, several areas in the Prince William Sound are so popular that camping sites, such as Blackstone Bay, Harriman Fiord, and Culross Passage, are in high demand and consequently limited in availability.

Range of Inventoried Settings and Capacity

Prince William Sound is predominantly in the Primitive and Semi-primitive recreation settings as shown in Figure 3-54b. As a result, the capacity for dispersed recreation is correspondingly low, compared to the Kenai Peninsula. The overall capacity, based on the inventoried ROS settings and the suitable land area, is 9,213,152 PAOT-days, given a recreation use season in Prince William Sound of 200 days (Figure 3-54c).

Figure 3-54b: Inventoried ROS classes – Prince William Sound.

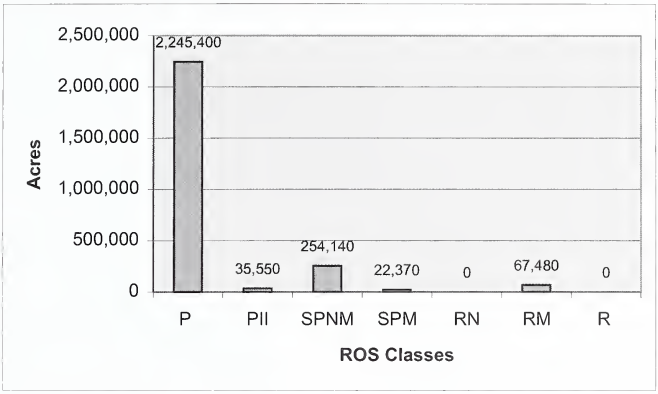
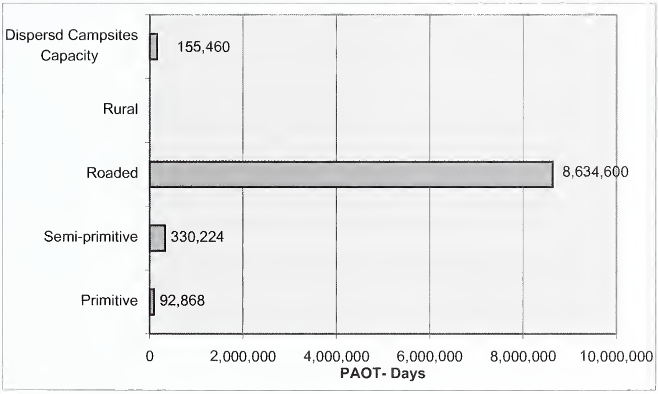


Figure 3-54c: Recreation capacities of dispersed areas – Prince William Sound



Interests and Situations

Prince William Sound has been managed to maintain the wild character of the area, both inside and out of the Wilderness Study Area. Significant interests for Prince William Sound revolve around:

- Maintaining the wild and natural character of the Sound, both inside and out of the Wilderness Study Area, including managing people's impacts on wildlife.
- Accommodating increased dispersed recreation pressures as a result of the new road to Whittier and anticipated increase in recreation and tourism visitors.
- Concentrations of people at developed recreation cabin sites exceeding available capacity.
- Need for additional recreational access away from areas of concentration and along shorelines.

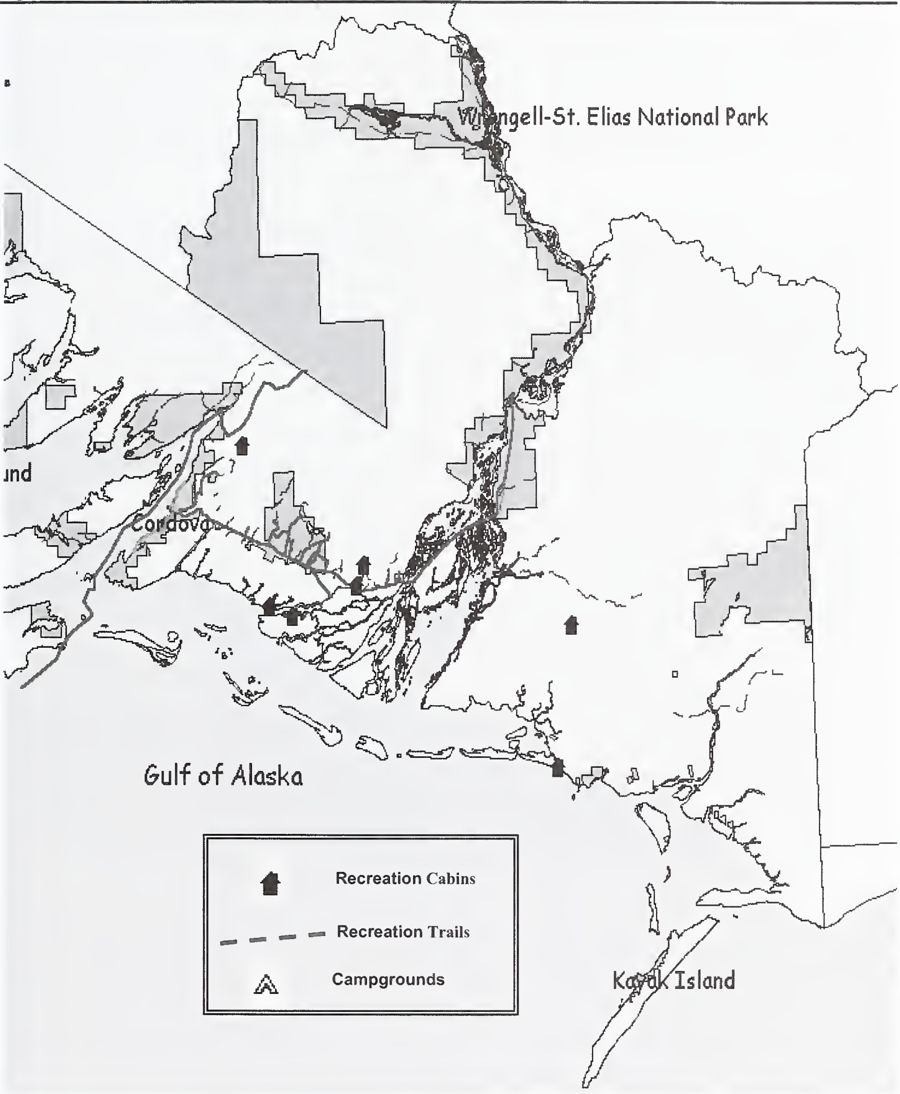
Copper River Delta

Character

Encompassing the eastern end of the Chugach Mountain range and the expansive delta of the Copper River is one of the richest wildlife areas of the world (Figure 3-55). Combined with spectacular scenery, massive valley glaciers, and wild and remote settings, the Copper River Delta is one of the premier and most challenging areas for primitive recreation on the west coast of North America.

The Copper River Delta is not connected to the rest of the state's road system; hence access is via the Alaska State Marine Highway to Cordova, commercial airline, and private aircraft and boats. The isolation and expense of access results in relatively low use levels compared to the rest of the Chugach National Forest. A 50-mile long primarily gravel road extends from Cordova on the Gulf of Alaska northeasterly to Childs Glacier in the rugged Chugach Mountains. All developed recreation opportunities are located along this road corridor, except for isolated recreation cabins.

Figure 3-55: Copper River Delta geographic area.



Types of Activities

Recreation use occurs primarily during the summer months along the road system with sightseeing, viewing nature, fishing, hiking, and picnicking being the most popular activities (Table 3-55e). Hunting is also one of the more popular activities. Winter use is very limited, however, as the road is not maintained past the airport (Mile 13).

Table 3-55e: Recreation visits by activity - Copper River Delta.

Recreation Activity	Total Visits Developed Sites	Total Visits Dispersed Areas	Total Visits Copper River Delta
Sightseeing	54,338	61,879	116,217
Visitor center, nature education	120,094	0	120,094
Wildlife/fish Viewing	5,111	6,692	11,803
Fishing	2,022	16,850	18,871
Hiking	8,026	16,304	24,330
Cross-country skiing	357	2,000	2,357
Primitive camping	0	4,882	4,882
Snowmachining	357	4,433	4,789
Developed camping	101	0	101
Picnicking	2,642	10,251	12,894
OHV, ATV, 4WD	0	1,828	1,828
Berry picking	6	2,123	2,128
Backpacking	0	3,964	3,964
Hunting	1,126	11,766	12,892
Biking	0	188	188
Canoe/raft/floating	770	4,101	4,871
Cabins	1,760	0	1,760
Motorboating	179	5,057	5,236
Climbing	0	111	111
Other	0	3,002	3,002
Total	**196,888**	**155,430**	**352,318**

Source: USDA Forest Service 1998 INFRA database (USDA Forest Service 1998c).

Existing Infrastructure and Capacity

The Copper River Delta has a very limited infrastructure (Table 3-55f). Developed facilities are located along the road corridor between Cordova and Childs Glacier. There are only five developed campsites for tents in one campground; 13 day-use sites, including the Million Dollar Bridge and Childs Glacier viewing sites; and, 66 miles of trails, many of which are maintained to a primitive standard.

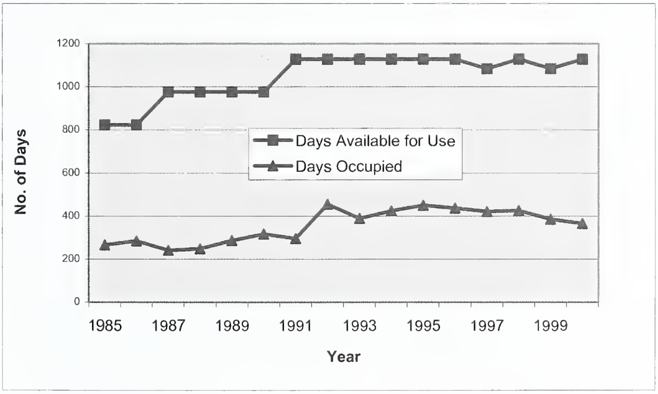
Table 3-55f: Developed recreation infrastructure and capacity - Copper River Delta.

Measures of Capacity and Use	Facility Types: Campgrounds	Cabins	Day Use Sites	Trailheads	All Trails	Winter Motorized Trails
PAOT-days	3,825	16,434	77,646	33,072	-	-
No. of facilities	1	8	13	9	-	-
No. of camping units	5	-	-	-	-	-
No. of camping units or cabin nights available during season	n/a	1,129	-	-	-	-
No. of camping units or cabin nights occupied during season	n/a	365	-	-	-	-
No. of trails	-	-	-	-	37	0
Miles of trails	-	-	-	-	105	78

Source: USDA Forest Service 1998 INFRA database (USDA Forest Service 1998c), Cabin reservation reports (2000), Campground use reports (2000).

Recreation cabins are typically reserved in association with specific fishing or hunting seasons (Figure 3-55a). Outside of these seasons, use is very low, except for the McKinley Trail Cabin, located just off the Copper River Highway.

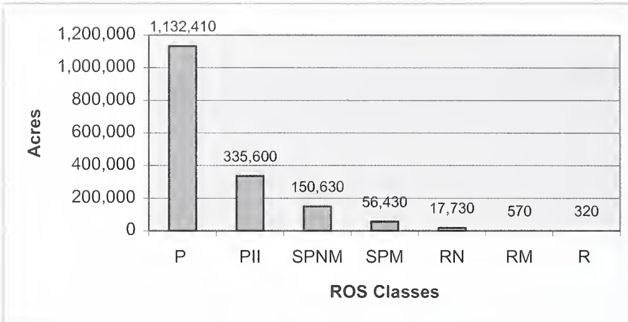
Figure 3-55a: Cabin occupancy - Copper River Delta.



Range of Inventoried Settings and Capacity

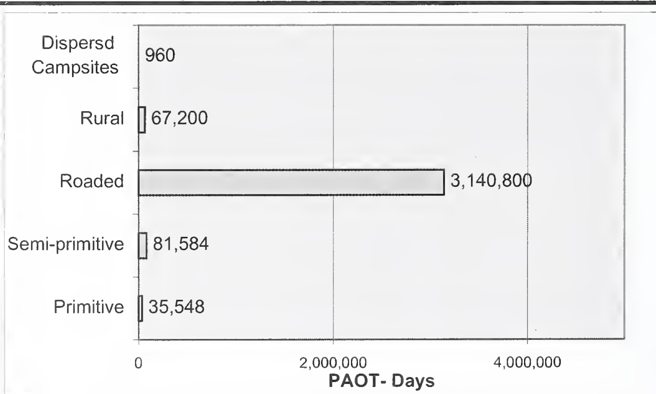
The Copper River Delta is much like Prince William Sound in being very wild and remote in character. Opportunities for Primitive and Semi-primitive recreation opportunities are very high (Figure 3-55b). Along the Copper River Highway between Cordova and Childs Glacier, the Roaded Natural ROS setting allows for relatively high use and development of facilities.

Figure 3-55b: Inventoried ROS classes – Copper River Delta.



Much of the Copper River Delta is Primitive and Semi-primitive ROS settings. As shown in Figure 3-55c, the capacity for dispersed recreation is correspondingly low, especially away from the Copper River Highway. The overall capacity, based on the inventoried ROS settings and the suitable land area available, is 3,326,092 PAOT-days, given a use season of 200 days.

Figure 3-55c: Recreation capacities of dispersed areas - Copper River Delta.



Interests and Situations
Although remote, the Copper River Delta is nationally prominent due to its rich fish and wildlife resources; proposals by the state to build a road or trail from Childs Glacier to Chitna; and proposals by private landowners to develop their resources with necessary access across National Forest System lands. Local interests are concerned that increased recreation uses could adversely affect their lifestyles.

Projections of Recreation Use

To evaluate the alternatives' responses to the Recreation/Tourism Situation Statement, both the current and future supply of recreation opportunities, as well as the current and future demand for recreation opportunities, need to be analyzed. In this section, the demand side is described by examining available information about current and projected participation in recreation activities.

In the following sections, people's participation in recreation activities nationally, statewide, and on the Chugach National Forest is characterized by describing results from a variety of recreation surveys. The best available information was then used to project future participation in recreation activities on the Chugach National Forest.

Recreation research, at its most basic, is a matter of studying the behavior of human beings. People's behavior is the external manifestation of complex internal decision-making. Measuring current behavior and using it, as a basis for predicting future behavior, can be very challenging. Recreation research, in general, has some widely shared inadequacies that arise from lack of consistency in definitions, lack of information about supply or capacity effects on demand, and lack of information about the effect of quality of experience on demand (Brooks and Haynes 2001). Nevertheless, several sources of information provide a reasonable overview of the current situation and a basis for projecting the future of recreation and tourism on the Chugach National Forest.

Recreation surveys commonly use three measures of recreation participation. One of the most common measures is **recreation participation**, also referred to as participation rates. Recreation participation is generally presented as a **percentage participation** in a recreation activity. In other words, recreation participation is the percentage or proportion of the population that participates at least once per year in a particular recreation activity. For example, 72 percent of Alaskan adults reported that they viewed wildlife at least one time in the year prior to being surveyed in the 1995 National Survey on Recreation and the Environment (Cordell et al. 1999).

Another measure of participation is **frequency of participation**, also termed "consumption". Frequency measures the number of times a person participates in an activity during the year. As an example, Alaskans, on average, viewed wildlife 28 times a year according to the Statewide Comprehensive Outdoor Recreation Plan of 1997 (Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation 1999). By multiplying this average frequency by

the total population, the total number of times people participate can be calculated.

The third measure, also a measure of frequency, is **number of primary purpose trips.** This measures the number of trips that a person makes annually for the primary purpose of participating in a particular recreation activity. For example, wanting to view wildlife got Alaskans out of the house an average of seven times per year.

In considering these measures of recreation participation, it can be deduced that almost three-quarters of Alaskan adults view wildlife at least once in a year, or they actually viewed wildlife 28 times in a year. However, viewing wildlife was their primary purpose for recreating only seven times a year. In other words, Alaskans viewed wildlife more often as a secondary activity while they were out recreating for some other primary purpose such as fishing with 22 primary purpose trips a year.

In developing projections for recreation use on the Chugach National Forest in 2010, the 1998 INFRA data for number of visits annually in each recreation activity was used. Total visits are a measure of frequency. To project number of visits to the Chugach National Forest by 2010, projections of the total number of times participating and a frequency measure, available in the work by Bowker and others (1999), were used. Only present projections to 2010 for this frequency measure are discussed here, although Bowker and others (1999) also provide projections to 2020 for participation percentages and number of primary purpose trips.

This discussion on recreation use projections is organized into the following topics:

- Information Sources for Recreation Use Data
- National Recreation Use and Projections
- Alaskan Recreation Use and Projections — Alaskan Residents
- Alaskan Recreation Use and Projections — Alaska Visitors
- Chugach National Forest Recreation Use
- Summary of Recreation Patterns
- Projections of Visits for Chugach National Forest

Information Sources for Recreation Use Data

For national level information on people's participation in outdoor recreation, we used the National Survey on Recreation and the Environment (NSRE) of 1995. The NSRE is a national recreation survey, which has been conducted by the federal government since 1960. Its data was used in an assessment of participation patterns and levels of participation across recreation activities. Results of the 1995 NSRE were published by Cordell and others, as Chapter V in "Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends" (Cordell et al. 1999). Projections of future participation in

recreation nationally were published as Chapter VI in this same book by Bowker and others (1999). (Although the NSRE was also conducted in 2000, projections for future participation have not yet been published.)

Results from the 1995 NSRE were also published in 1997 by Cordell and others in "Outdoor Recreation in the United States: Results from the National Survey on Recreation and the Environment. A Report for USDA Forest Service Recreation Managers and Planners" (Cordell et al. 1997). This publication includes comparisons between the national data and data for Alaska.

The Statewide Comprehensive Outdoor Recreation Plan of 1997 (SCORP) provides an inventory of outdoor recreation needs, trends, and issues in Alaska (Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation 1999). Part of this planning process included a survey of 600 Alaskan households randomly selected to discover what recreation activities they currently participate in.

Information about trends in the U.S. population was primarily obtained from the U.S. Department of Commerce, Bureau of the Census (1996). The Forest Service also commissioned three studies to compile and analyze the best available information regarding current recreation and tourism and its future on the Chugach National Forest.

The first study is titled "Recreation and Tourism in Southcentral Alaska: Patterns and Prospects" by Colt and others (in press). The report's purpose is to describe the nature and extent of recreation and tourism activities in Southcentral Alaska and specifically on the Chugach National Forest. The report considers current levels of such activities, past trends in these activities, and future prospects for change. The authors used a variety of data sources from the region for the past ten years, when available, along with semi-structured interviews with 120 key informants. Colt and others used the different sources to supplement each other, resulting in aggregate data that is more informative than the individual sources (Brooks and Haynes 2001).

The second study is "Outdoor Recreation Participation and Use by Alaskans: Projections 2000-2020" by J. M. Bowker for the Pacific Northwest Research Station, U.S. Forest Service (Bowker 2001). Its research objectives were to "(1) estimate Alaska State level participation and use across a number of popular outdoor recreation activities, (2) estimate nonresident participation in wildlife related recreation in Alaska, and (3) provide forecasts of participation and use for the above two objectives at ten-year intervals through the year 2020."

Bowker used three sources of data to meet these objectives, including the 1997 Alaska Statewide Comprehensive Outdoor Recreation Plan; the 1996 National Survey of Fishing, Hunting, and Nonconsumptive Wildlife-Associated Recreation; and the 1995 National Survey on Recreation and the Environment. These data sources are origin-based recreation surveys. In this type of survey, a sample of households is surveyed to obtain information about people's recreation preferences and behavior, but generally no data is solicited about where the people recreate. Therefore, there is no way to determine whether, or how often,

a person participated in a recreation activity in a specific location such as the Chugach National Forest (Bowker 2001). However, Bowker states "enough information is available to generally assess participation and use levels for Alaskans across a wide range of outdoor recreation activities and for tourists in wildlife related activities."

David Brooks and Richard Haynes provided a third report titled "Recreation and Tourism in Southcentral Alaska: Synthesis of Recent Trends and Prospects" (2001). This report is designed to "highlight the findings of Colt and Bowker; place these findings in a larger context; identify both linkages and gaps in the information they provide; and draw broad-scale conclusions." The authors note that the two studies do not address some important questions identified in the Analysis of the Management Situation (USDA Forest Service 1998b): they do not describe the management plans of adjacent public and private landowners; they do not provide an analysis of capacity (supply); and, they do not integrate the concept of quality of experience into demand analysis. As noted earlier, these shortcomings are not unique to these studies and are not barriers to providing a "contemporary review of trends and prospects for this sector" (Brooks and Haynes 2001). Also lacking are projections for visitors' recreation activities while in Alaska, with the exception of fish and wildlife related recreation, due to the lack of survey information about nonresidents' participation in the entire range of recreation activities while visiting Alaska.

Finally, the staff of the Chugach National Forest conducted an on-site survey of recreation users in 1995, called Recreation Survey '95 (Reed 1995). The self-administered questionnaire resulted in almost 2500 responses during the summer of 1995. The survey's objectives were to collect information regarding demographics; recreation activity participation; management actions and services most important and satisfactory to recreationists; and people's perceptions of current Forest management practices. Some of the limitations of the survey include its timeframe of mid-June through mid-September, which means winter sports and hunting are underrepresented. Dispersed recreationists may also be underrepresented, due to the methodology of distributing the questionnaires. Because this survey was designed to survey on-site visitors to the Forest, it can only be generalized to that group of people. Unlike the NSRE, it was not designed as a random survey of all possible households that might use the Forest.

National Recreation Use and Projections

The purpose of looking at national level data is to understand recreation activities of the U.S. population as a whole. The majority of visitors to Alaska are from the United States. Additionally, national level data is used in projections of visitors' activities while in Alaska due to the lack of Alaska-specific data about visitors' recreation preferences.

The 1995 National Survey on Recreation and the Environment (NSRE) contains a wealth of information about Americans' participation in over 80 outdoor activities (Cordell et al. 1997). The activities included in the survey range from

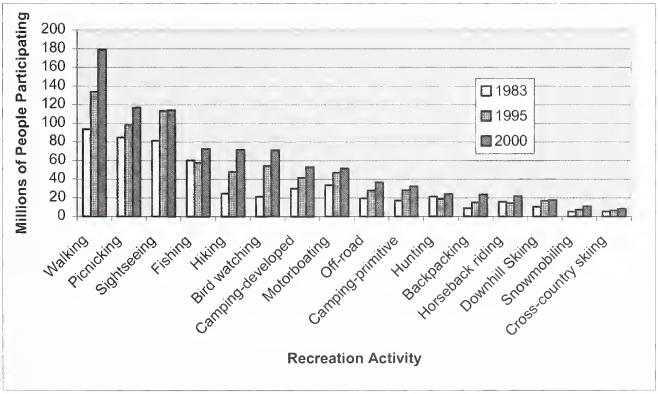
casual walking and sightseeing, to camping and fishing, to whitewater rafting and snowmobiling. Information in the survey comes from telephone interviews with approximately 17,000 Americans 16 years and older, chosen randomly. People were asked questions pertaining to their participation in outdoor recreation activities, and the total number of days annually they spent participating in those activities. The survey does not ask people where they recreate, but only *if* they participated in specific activities at least once in the previous year. For example, a person reporting he or she had picnicked in the previous year is not asked if the picnic was at a local city park or at a beach in another state.

Recreation Participation

Results of the 1995 NSRE show that 94.5 percent of the American population (approximately 189 million people) participated in one or more of the surveyed recreation activities sometime in the 12 months prior to the survey (Cordell et al. 1999). Initial results from the 2000 NSRE show that participation has increased to 97.5 percent of the population (207 million adults) (USDA Forest Service and National Oceanic and Atmospheric Administration 2000).

National recreation surveys from 1983, 1995, and 2000 include data on several recreation activities that can be compared over these time periods. (The 1983 survey data was included in Cordell et al. 1999.) Figure 3-56a displays the number of people participating in these activities in 1983, 1995, and 2000, ranked in descending order of popularity. These same data are presented in tabular form in Table 3-56a following the graph.

Figure 3-56a: Numbers of U.S. adults participating in selected outdoor recreation activities in 1983, 1995, and 2000 (see also Table 3-56a).



Adapted from Table V.10, in Cordell et al. 1999 and from Tables 1-4 in NSRE 2000.

Table 3-56a: Numbers of people, 16 years and older, participating in selected outdoor recreation activities in 1983, 1995, and 2000, and percentage increase in participation from 1983 to 2000.

Recreation Activity	1983	1995	2000	1983 to 2000
	No. in Millions	No. in Millions	No. in Millions	Percent Change
Bird watching	21.2	54.1	71.2	236
Hiking	24.7	47.8	71.4	189
Backpacking	8.8	15.2	23.4	166
Primitive area camping	17.1	28.0	32.3	89
Off-road (4-wheel, ATV,motorbike)	19.4	27.9	36.7	89
Walking	93.6	133.7	179.1	91
Sightseeing	81.3	113.4	114.1	40
Developed area camping	30.0	41.5	52.9	76
Picnicking	84.8	98.3	116.6	38
Horseback riding	15.9	14.3	21.7	36
Hunting	21.2	18.6	24.0	13
Motorboating	33.6	47.0	51.4	53
Fishing	60.1	57.8	72.4	20
Downhill Skiing	10.6	16.8	17.6	66
Snowmobiling	5.3	7.1	11.0	108
Cross-country skiing	5.3	6.5	8.1	53

Adapted from Table V.10, in Cordell et al. 1999 and from Tables 1-4 in NSRE 2000.

All of the activities in Figure 3-56a and Table 3-56a show increases from 1983 to 2000. By far the most popular outdoor recreation activity in 2000 was walking, with almost 180 million people participating (84 percent of people 16 years and older). Picnicking and sightseeing are also very popular, with almost 117 million and 114 million participants (approximately 54 percent of the population). These activities require modest skills and are generally low cost, so they appeal to a broad range of people (Cordell et al. 1999). They can also be enjoyed in settings close to home, such as streets, city trails, and city parks. Activities with the lowest levels of participation are the winter sports, followed by horseback riding, backpacking, and hunting.

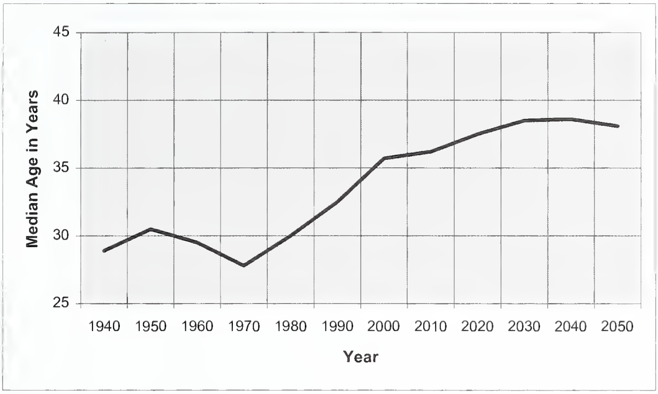
Some of the increase in recreation participation over time is due to the overall growth in the U.S. population, which was approximately 18 percent for the total population, based on data and on census projections (U.S. Department of Commerce, Bureau of the Census 1996). It should be noted that a high percentage increase does not necessarily mean a large number of people are participating in the activity, or vice versa. For example, the percentage increase in sightseeing from 1983 to 2000 was 40 percent, which represents an increase of 32.8 million participants. In contrast, the percentage increase in snowmobiling was 108 percent, which represents an additional 5.7 million adults participating. If the number of people participating was already high in 1983, even modest growth rates will result in large increases in total participants.

<u>Aging Population</u>

People's participation in recreation activities show some differences based on age. The often-discussed aging of the American population will likely affect future participation rates in different activities. Statistics from the Bureau of the

Census (U.S. Department of Commerce, Bureau of the Census 1996) show that the future population will be older in 2050 than it was in 1995. The increase in the median age of the population is driven by the aging of the Baby Boom generation, born between 1946 and 1964. In 2011, the first members of the Baby Boom will reach age 65. Figure 3-56b shows the change in median age from 1940 projected to 2050.

Figure 3-56b: Median age of U.S. population from 1940 to 2050.



Adapted from Figure 5, p. 8 in U.S. Department of Commerce, Bureau of the Census 1996.

Age-related preferences for participating in recreation activities were evaluated in the NSRE (Cordell et al. 1999). The data show that 70 to 89 percent of the participation in an activity is by "enthusiasts", who are classified by the number of days they participate annually in an activity. Based on this classification, activities for which enthusiasts are most likely to be over the age of 50 are walking, bird watching, fish and wildlife viewing, sightseeing, and coldwater fishing. Future participation in recreation activities currently enjoyed by Americans in older age groups can be expected to increase as Baby Boomers enter those age groups. For example, Cordell notes: "With the number of people in their 70's and older increasing rapidly in the United States, one can easily picture the popularity of outdoor walking continuing to increase" (Cordell et al. 1997).

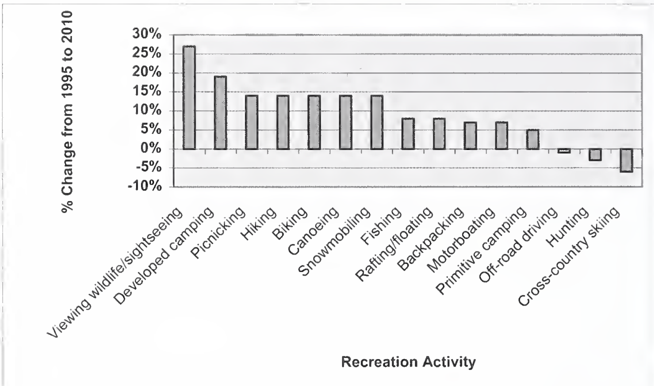
<u>Projections of Future Participation</u>

Bowker and others (1999) projected future outdoor recreation participation and consumption in ten-year increments out to 2050, using the data from the 1995 NSRE. One model estimates the probability that an individual will participate in a given recreation activity based on the individual's characteristics (age, sex, income, etc.) and the recreation opportunities near the individual's residence. A second model was used to estimate annual days an individual will spend in a

given outdoor recreation activities. To the extent that today's behavior is a good indicator of future behavior, these types of models can be used to estimate future recreation participation and consumption.

Estimated changes in future participation rates for the U.S. adult population are shown in Figure 3-56c.

Figure 3-56c: Percent change in U.S. adult participation in selected recreation activities, 1995 to 2010.



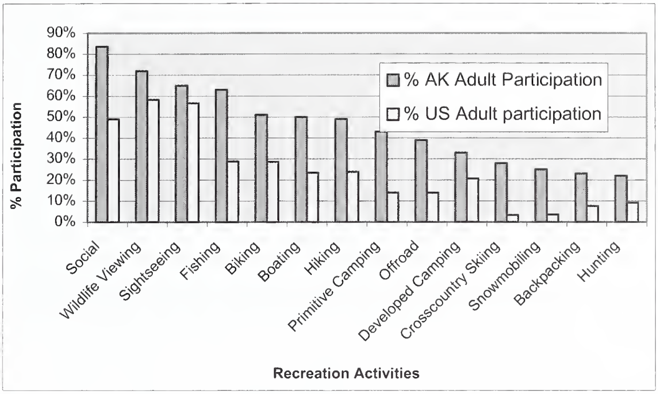
Adapted from Tables VI.3 through VI.24, Bowker (1999).

Three activities are projected to decrease in the percentage of the adult population participating by 2010: off-road driving, hunting, and cross-country skiing. All other activities are projected to show increases in percentage participation, with the largest increase in viewing wildlife and sightseeing.

Alaskan Recreation Use and Projections—Alaska Residents

Outdoor recreation is a way of life for Alaskans. The estimated proportion of Alaskan adults who participate in outdoor recreation activities is generally much higher than for the rest of the U.S. adult population (Bowker 2001). For many activities, rates of participation by Alaskans are at least three times the national average (Brooks and Haynes 2001). Figure 3-57a compares participation rates for Alaskan adults and the U.S. population as a whole in a variety of recreation activities.

Figure 3-57a: Participation rates by Alaskan adult population and U.S. adult population in outdoor recreation activities in 1995.



Sources: Bowker (2001); Bowker (1999).

Information about Alaskans participating in outdoor recreation is primarily available from two sources: state-by-state summaries of the 1995 NSRE (Cordell et al. 1997), and the 1997 State Comprehensive Outdoor Recreation Plan (SCORP) for Alaska. The SCORP survey indicates that residents place a high value on the availability and quality of outdoor recreation opportunities: 92 percent said parks and outdoor recreation were important or very important to their lifestyle (Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation 1999).

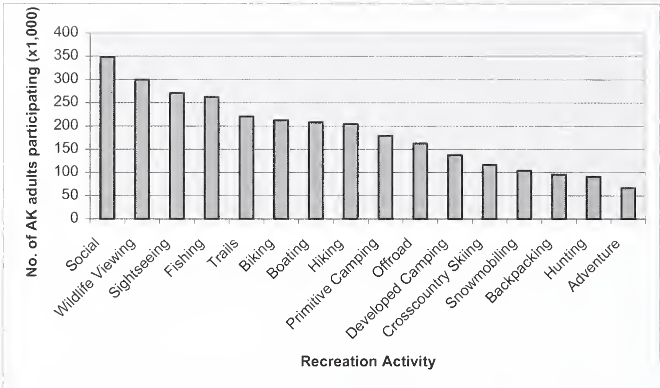
These two sources of data were used by Bowker (2001) to establish current patterns of Alaskan residents' recreation activities. The two data sets together provide information on the percentage of Alaskans that participate in specific activities; the number of times in a year they participate in a particular activity; and how often specific activities are the primary reason for a recreation trip.

Recreation Participation

Activity participation rates for Alaskan adults across the two data sets are reasonably consistent (Bowker 2001). According to Bowker's analysis, estimates derived from the 1997 SCORP data generally run higher than the 1995 NSRE estimates, for comparable activities. For the purposes of the following discussion of current and projected participation, only the 1995 NSRE estimates are displayed, which will facilitate comparison with national NSRE data presented previously. The SCORP data, however, will be used in projecting Alaskans' future recreation visits to the Chugach National Forest.

Figure 3-57b was developed using Bowker's estimates of the percentages of Alaskans participating in a variety of recreation activities, and the Bureau of the Census data on the number of Alaskan adults in 1995 (U.S. Department of Commerce, Bureau of the Census 1996).

Figure 3-57b: Number of Alaskan adults participating in outdoor recreation activities in 1995.



Adapted from Table 2b, Bowker (2001) and U.S. Department of Commerce, Bureau of the Census data (1996)..

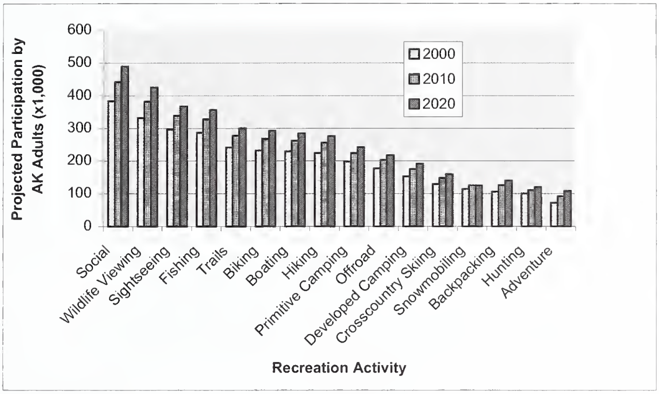
Four of these activities are enjoyed by two-thirds or more of the population: 84 percent participate in social activities (picnicking); 72 percent in wildlife viewing; 65 percent in sightseeing; and 63 percent in fishing. Generally, these types of recreation are day activities which can be done in a variety of settings, are often done along with other recreation activities, and generally are low cost and do not require high skill levels, other than fishing (Bowker 2001).

Projections of Future Participation

Estimates of future participation by Alaskan adults were developed by Bowker (2001) using the 1995 NSRE dataset and a population-based model. This type of model is based on the premise that a person's participation in outdoor recreation can be correlated with factors such as age, sex, income, and race. These types of models are typically used by recreation researchers to forecast participation and use levels by recreation activity. A limitation of this type of model is that it assumes that the factors that influence participation or use are constant into the future. It therefore cannot predict changes in participation or use due to new recreation technology, such as the growth in mountain biking and snowboarding. However, given the available data, this model is a reasonable way to estimate and forecast participation and use (Bowker 2001).

Projected participation of Alaskan adults in recreation activities out to 2020 are presented in Figure 3-57c and Table 3-56b.

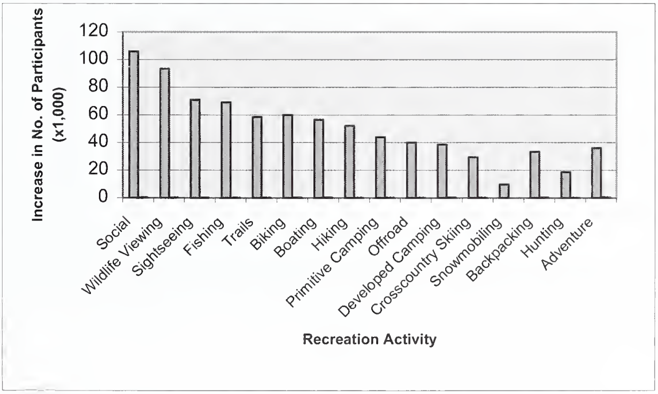
Figure 3-57c: Alaska statewide outdoor recreation participation estimates, 2000-2020, using the 1995 NSRE database (see also Table 3-56b).



Adapted from Table 2b, Bowker (2001).

The projected increases in actual numbers of people participating in specific activities from 2000 to 2020 are displayed in Figure 3-57d.

Figure 3-57d: Increase in number of adult Alaskans participating in recreation activities, from 2000 to 2020 (see also Table 3-56b).



Adapted from Table 2b, Bowker (2001).

Figure 3-57d indicates that the largest increase in numbers participating will be in social activities (picnicking) at 106,000. The smallest increase is predicted in snowmobiling with an additional 9,700 participants by 2020. Eight activities are predicted to have increases of 50,000 or more by 2020: social activities, wildlife viewing, sightseeing, fishing, trail activities, biking, boating, and hiking. Percentage increases are a function of both the actual numbers initially participating as well as the rate of increases.

The participation in recreation activities within a population is a result of overall population growth and per capita participation. In general, Bowker's model predicts that there will be little change over time in the per capita participation rate. However, the total number of people participating will change considerably due to the Alaska population growth, which is projected to be 28 percent from 2000 to 2020 (Bowker 2001). With the exception of snowmobiling, hunting, and adventure activities, most recreation activities are predicted to increase at about the same rate as overall population growth (Table 3-56b).

Table 3-56b. Alaska statewide outdoor recreation participation projections, 2000-2020, using the 1995 NSRE database.

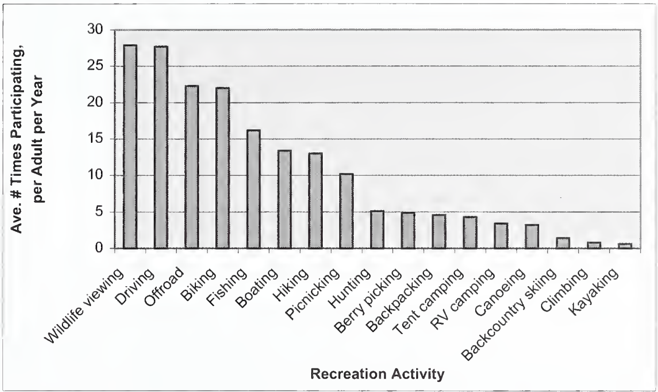
Recreation Activity	1995 Participation		Projected Participation, 2000 to 2020				
	Percent AK Adult Participation in 1995	Number of AK Adults Participating in 1995 (x1,000)	Projected Number of AK Adults Participating in 2000-2020 (x1,000)			Increase in Number of AK Adults Participating 2000-2020 (x1000)	Percent Increase in Participants 2000-2020
			2000	2010	2020		
Social	84	348	384	442	490	106	28
Wildlife Viewing	72	300	332	382	425	93	28
Sightseeing	65	271	296	339	367	71	24
Fishing	63	262	287	329	356	69	24
Trails	53	221	242	277	300	59	24
Biking	51	212	232	269	292	60	26
Boating	50	208	229	262	285	57	25
Hiking	49	204	224	256	276	52	23
Primitive Camping	43	179	198	225	242	44	22
Offroad	39	162	178	204	218	40	23
Developed Camping	33	137	153	175	192	39	25
Cross-country Skiing	28	117	130	148	159	29	23
Snowmobiling	25	104	115	125	124	10	8
Backpacking	23	96	107	126	140	34	31
Hunting	22	92	101	111	120	19	18
Adventure	16	67	72	92	108	36	50

Adapted from Table 2b, Bowker (2001).

Participation Times

The second aspect of use is the frequency of participation in recreation activities, referred to as "consumption" by Bowker. Using data from the 1997 SCORP, Figure 3-57e displays the average number of times an Alaskan participates in an activity in a year. This measure of frequency is also termed per capita rate.

Figure 3-57e: Average number of times an Alaskan adult annually participates in recreation activities (see also Table 3-56c).



Adapted from Table 3a, Bowker (2001).

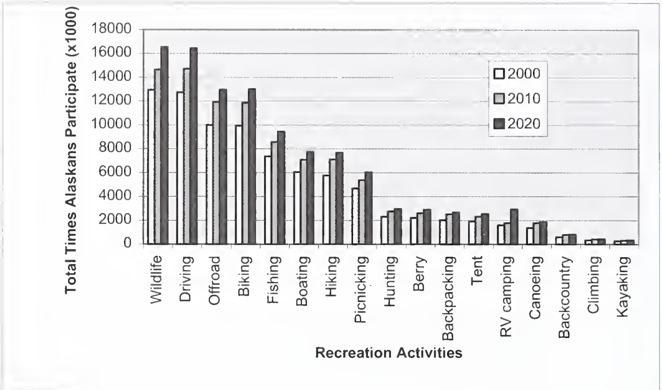
On an annual average, the five activities Alaskan adults participate in most often are wildlife viewing (28 times per year); driving for pleasure or scenic driving (almost 28 times annually), off-road vehicles including OHVs and snowmachines (about 22 times a year); biking including mountain biking (22 times per year); and fishing (16 times per year).

As with participation, these estimates indicate that Alaskan adults more frequently participate in activities that are relatively lower in cost and skill requirements than other activities in the survey, with the exception of fishing.

Projections of Participation Times

Bowker used data from the 1997 SCORP to model future trends in number of times Alaskan will participate in recreation activities. Figure 3-57f and Table 3-56c project total numbers for the entire Alaskan population.

Figure 3-57f: Projected increases in total times Alaskans participate in recreation activities, 2000 to 2020 (see also Table 3-56c).



Adapted from Table 3a, Bowker (2001).

Table 3-56c: Number of times adult Alaskans participate in recreation activities, per capita and projected total times for total population, 2000 to 2020.

Recreation Activity	Average Annual Times Participating per Adult	Projected Total Times of Population Participation (x1,000)			Projected Increase in Total Times	Projected Percent Increase in Total Times
		2000	2010	2020		
Wildlife viewing	27.9	12,950	14,658	16,544	3,594	28
Driving	27.7	12,739	14,726	16,434	3,695	29
Off Road	22.3	9,987	11,948	12,970	2,983	30
Biking	22.0	9,937	11,875	13,012	3,075	31
Fishing	16.2	7,366	8,590	9,456	2,089	28
Boating	13.4	6,047	7,090	7,742	1,695	28
Hiking	13.0	5,776	7,128	7,694	1,918	33
Picnicking	10.2	4,670	5,370	6,037	1,368	29
Hunting	5.1	2,315	2,755	2,970	655	28
Berry picking	4.9	2,219	2,609	2,904	685	31
Backpacking	4.6	2,033	2,515	2,684	650	32
Tent camping	4.3	1,918	2,338	2,547	629	33
RV camping	3.4	1,595	1,791	2,932	436	27
Canoeing	3.2	1,373	1,782	1,861	488	36
Backcountry skiing	1.4	606	793	829	223	37
Climbing	0.8	329	415	433	104	31
Kayaking	0.6	267	311	344	77	29

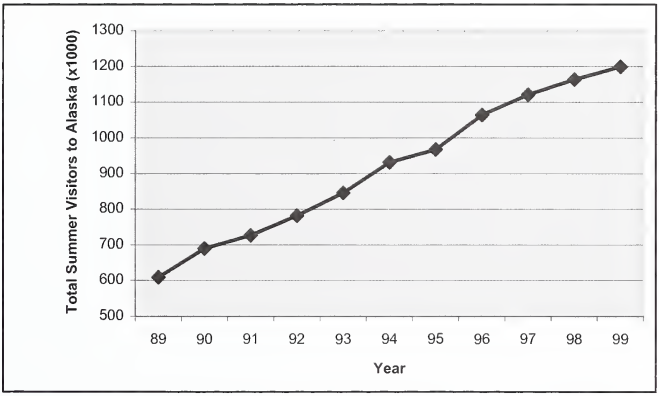
Adapted from Table 3a, Bowker (2001).

Alaskan Recreation Use and Projections—Alaska Visitors

The terms "tourist", "visitor", and "nonresident" in this analysis refer to people who visit Alaska for the purpose of recreation and leisure. Such visitors are estimated to spend at least $1 billion a year (Brooks and Haynes 2001). Precise measures of tourism as an economic sector are difficult, due to limitations in how economic data are reported with respect to tourism related activity. Nevertheless, tourism is now reported to be the state's second largest private sector employer, providing one of every eight private sector jobs (Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation 1999).

The number of summer visitors to Alaska has grown steadily over the last decade, as shown by arrival data from the Alaska Visitor Statistics Program (Figure 3-58a). Total numbers of visitors almost doubled from 1989 to 1999.

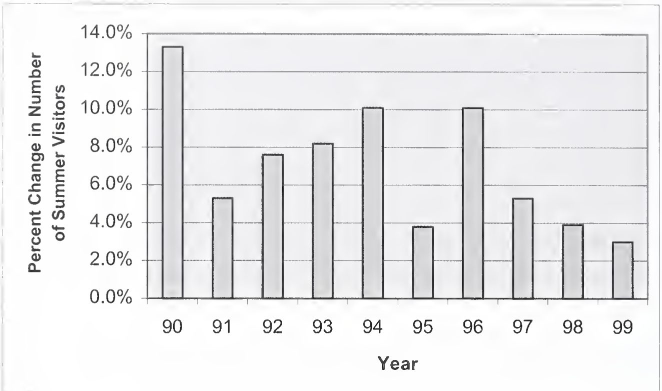
Figure 3-58a: Total visitors entering Alaska during May through September, 1989 to 1999.



From Alaska Visitor Statistics Program, McDowell Group 1999.

Overall, visitor volume grew moderately in the late 1980s, followed by a period of rapid growth in the early to mid-1990s. From 1997, the rate of growth has slowed and started decreasing, as shown in Figure 3-58b.

Figure 3-58b. Rate of growth in total summer visitors to Alaska, 1989 to 1999.



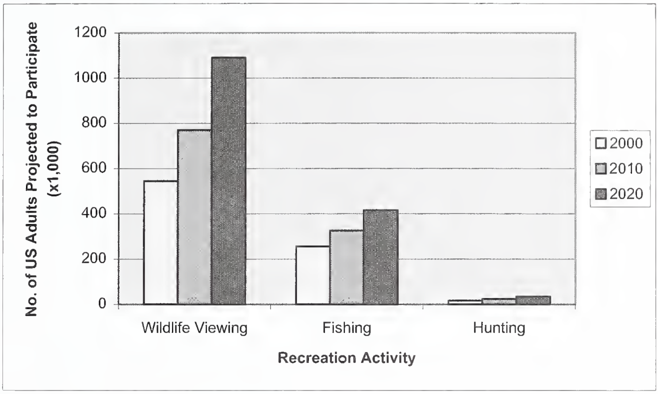
From Alaska Visitors Statistics Program, McDowell Group, 1999.

Brooks and Haynes (2001) conclude that the "growth in total numbers of participants in tourism in Alaska has slowed from the rate of growth observed in the early to mid-1990s." Evidence includes summer arrival figures, bed tax receipts, harbor taxes, etc.

However, some categories of activities for the Chugach National Forest area are increasing rapidly. Colt and others (in press) report that activities such as whitewater rafting, guided kayaking, guided hiking, snowmachine tours, and helicopter skiing are increasing rapidly, based on business license data and their structured interviews with knowledgeable tourism operators in small, medium, and large businesses, and people in communities close to the Chugach National Forest. Between 1993 and 1998, the number of business licenses for enterprises associated with tourism and located near the Chugach National Forest, increased by nearly six percent per year, compared to no net increase for all of Southcentral Alaska and only 2.5 percent for all of Alaska (Brooks and Haynes 2001). During this same period (1988 to 1999) commercial recreation special use permits increased 184 percent or about 12 percent per year. One possible inference is that more of these new businesses are operating on the Forest.

Data on tourist participation in particular recreation activities is not available in the same amount of detail as for the U.S. population as a whole or for Alaskan residents. However, a 1996 survey by the U.S. Fish and Wildlife Service does provide information about tourist participation in wildlife-related recreation in Alaska. Bowker (2001) used data from this Fishing, Hunting, and Nonconsumptive Wildlife-Associated Recreation to project U.S. adult participation in these activities when visiting Alaska (Figure 3-58c).

Figure 3-58c: Projections of participation by U.S. adults (excluding Alaskans) in wildlife-related recreation activities in Alaska.



Adapted from Table 2d, Bowker (2001).

Figure 3-57c and Figure 3-58c reveal that for wildlife viewing, visitors to Alaska will outnumber Alaskans by almost three to one by 2020 (1.1 million visitors participating in wildlife viewing vs. 425,000 Alaskans viewing wildlife in 2020). The growth rate for wildlife viewing by visitors is a 100 percent increase, while the growth rate for Alaskans is a 28 percent increase. The growth rate for nonresident anglers will also exceed the growth rate for Alaskans by about 50 percent. One factor that is not accounted for in these modeled projections is the effect of supply on growth. If the supply of facilities or sites does not change from 2000 to 2020, the stable capacity and/or people's sense of crowding may result in a decrease in the projected growth rate (Bowker 2001).

Chugach National Forest Use and Projections

The limitations of Forest Service data regarding recreation and tourism use on the Chugach National Forest are well described by Colt and others (in press). These limitations include quantitative data for a relatively small number of the many recreation activities people participate in on the Forest; non-systematic biases in observations; and major changes in methodologies and activity definitions between 1995 and 1997, resulting in an inability to develop trend information across that time period for activities other than developed camping and cabin use.

Even with the many limitations of available data, there is ample evidence that the Chugach National Forest is heavily used as a scenic resource by motorists and waterborne passengers and, increasingly, as a place for road-accessible fishing, camping and motor-assisted recreation (Brooks and Haynes 2001). In the following sections, we will review and highlight the data and information that

provide an overview of current patterns of recreation and tourism on the Chugach National Forest, and that provide the basis for assumptions used in making projections of future demand.

Demographics of Chugach National Forest Recreationists

The Recreation Survey '95 on the Chugach National Forest included questions related to age, sex, and residence (Reed 1995). Across all activities surveyed, 55 percent of participants were male. Men are especially predominant in hunting (88 percent). The activity with the highest participation by women was viewing interpretive sites and information services at 57 percent.

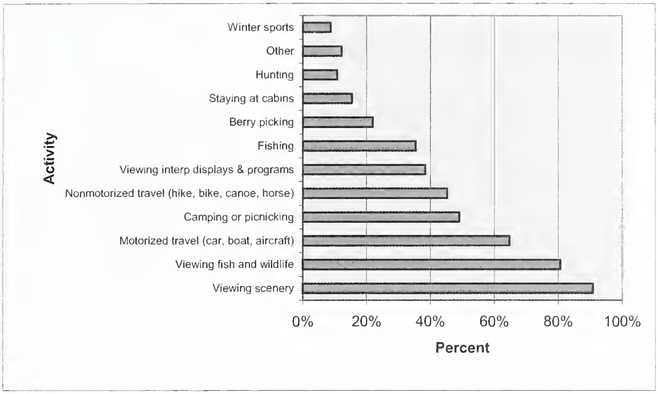
Forty-six percent of the respondents were aged 21 to 45, and thirty-four percent were aged 46 to 65. For most recreation activities, participation rates were approximately equal for those 45 years and younger and those over 45 years of age. However, a few activities showed distinctly different rates of participation based on age. The most striking difference is in nonmotorized travel such as hiking, biking, and canoeing, where 74 percent of people 45 years and younger participated, and 22 percent of people over 45 years of age participated. A larger percentage of people in the younger age class than the older class reported using cabins: 60 percent vs. 36 percent. There was a slightly larger percentage of people in the older age class who participated in motorized travel such as driving for pleasure and boating: 52 percent vs. 42 percent of people 45 years and younger. These findings are similar to conclusions from the 1995 NSRE that older age groups participate at a higher rate in less physically demanding activities (Cordell et al. 1999).

The Recreation Survey '95 also provides information about the places of origin for recreationists on the Chugach National Forest. The Chugach National Forest is the "backyard" recreation area for the Municipality of Anchorage, where 42 percent of all Alaskans live (Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation 1999). Data from the Survey showed that 23 percent of Forest visitors came from Anchorage with another 16 percent from the rest of Alaska (Reed 1995). Approximately two-thirds of visitors to the Chugach National Forest came from outside of Alaska, with six percent of those visitors being from foreign countries.

Participation

The Recreation Survey '95 provides a snapshot of participation rates among people who were actually visiting the Chugach National Forest in the summer of 1995. Because the survey was conducted only in the summer, participation in winter sports and hunting are underrepresented. In addition, the survey may over represent people recreating at developed sites because people are easier to survey in areas of concentrated use. Figure 3-59a displays the participation rates from the survey.

Figure 3-59a: Percentage participation in recreation activities on the Chugach National Forest, based on Recreation Survey '95.

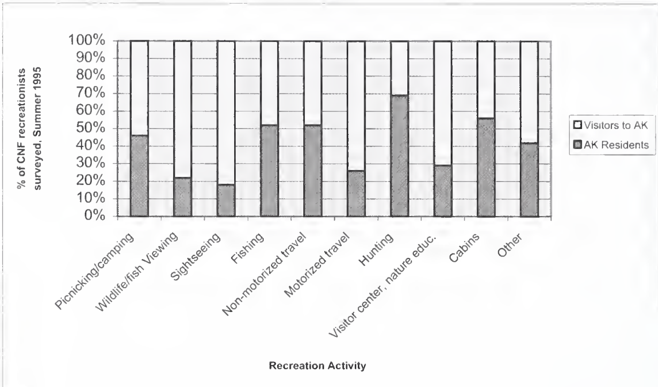


Adapted from Table 77, Reed (1995).

The three activities most commonly engaged in by recreationists on the Chugach National Forest are viewing scenery, viewing fish and wildlife, and motorized travel (vehicles, boats, aircraft). Taking into account that the Recreation Survey '95 on the Chugach National Forest and the NSRE categorize activities somewhat differently, Figure 3-59a, along with Figures 3-56a and 3-57b, are fairly consistent in showing that nationally, statewide, and on the Chugach National Forest, the most popular activities are viewing scenery or sightseeing, viewing fish and wildlife, and social activities such as picnicking or camping.

The proportion of visitors and residents participating in different recreation activities varied, as shown in Figure 3-59b.

Figure 3-59b: Participation rates of visitors and residents in recreation activities on the Chugach National Forest, summer 1995.



Adapted from Tables 3, 20, 37, 54, 71, Recreation Survey 1995 (Reed, 1995).

Participation in picnicking/camping, fishing, and nonmotorized travel was about evenly split between residents and visitors. Visitors engaged in wildlife/fish viewing, sightseeing, motorized travel, and going to visitor centers at far higher rates than did residents.

For Alaskans recreating on the Chugach National Forest, Anchorage residents constitute a somewhat higher percentage than Alaskans from other parts of the state (23 percent vs. 16 percent). Data from the SCORP survey shows that Anchorage residents demonstrate different recreation preferences or behavior from the rest of Alaskans (Bowker 2001). A greater proportion of Anchorage residents participate in or more frequently participate in the following activities, compared to other Alaskan residents:

Anchorage Participation Rate is **Higher**	Anchorage Frequency is **Higher**
• Biking • Canoeing • Climbing • Scenic driving • RV camping • Tent camping	• RV camping • Tent camping

For other activities, the participation rate and frequency are significantly lower for Anchorage residents compared to other Alaskans:

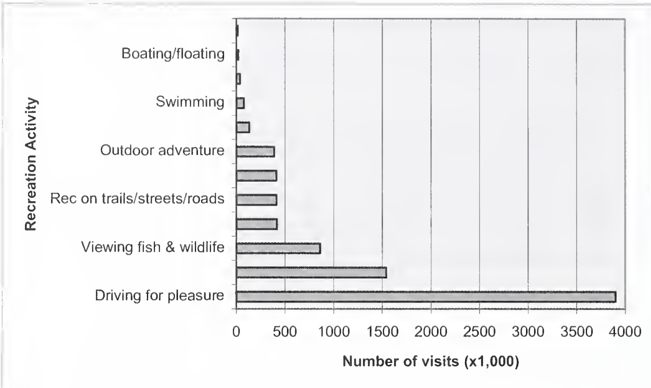
Anchorage Participation Rate is **Lower**	Anchorage Frequency is **Lower**
• Berry picking	• Berry picking
• Boating	• Wildlife viewing
• Hunting	• Boating
• Kayaking	• Off-road
• Picnicking	• ORV driving

Other activities showed no statistical differences between Anchorage residents and their fellow Alaskan:

Anchorage Participation Rate is **Similar**	Anchorage Frequency is **Similar**
• Backpacking	• Backpacking
• Backcountry skiing	• Backcountry skiing
• Wildlife viewing	• Biking
• Fishing	• Canoeing
• Hiking	• Climbing
• Off-road	• Fishing
• ORV use	• Hiking
	• Hunting
	• Kayaking
	• Picnicking
	• Scenic driving

Another snapshot of people's participation in different recreation activities on the Chugach National Forest is INFRA data from 1998, shown in Figure 3-59c. The Forest Service's INFRA data has been aggregated into categories similar to those used in the NSRE for ease of comparison. Whereas the NSRE data shows the number of people who participate in an activity, the INFRA data shows the number of visits made annually to the Chugach National Forest to participate in a particular activity. It also measures people of all ages, not just adults.

Figure 3-59c: Total visits to the Chugach National Forest to participate in recreation activities, based on 1998 INFRA data.



Adapted from USDA Forest Service 1998 INFRA database (USDA Forest Service 1998c).

Sightseeing/Driving for Pleasure generates by far the most use on the Chugach National Forest. A distant second is visiting the Forest's two major visitor centers in Portage Valley and Valdez, followed by viewing fish and wildlife. Viewing and learning ranks high, primarily due to the Begich, Boggs Visitor Center being a major attraction in the state. In 1993, it was the most visited site among major Alaskan attractions, according to the Alaska Visitor Statistics Program. The overwhelming predominance of sightseeing and driving for pleasure is a result of several factors. First, as noted earlier, out-of-state visitors comprise two-thirds of Forest visitors. The Recreation Survey '95 data indicate that they cite viewing scenery and motorized travel most often as their primary reason for visiting the Forest. Secondly, Anchorage residents comprise 23 percent of visitors to the Forest, and they participate in scenic driving at a significantly higher rate than other Alaskans (Bowker 2001).

Commercial Use

Colt and others (in press), analyzing Forest Service special use permit data, conclude that there has been an increase, perhaps substantial, in the role of businesses in supporting and promoting recreation use of the Chugach National Forest. The number of clients in all activities provided for by special use permittees roughly doubled from 1994 to 1998. Numbers of guided clients in a few activities, including primitive camping, kayaking, and hiking, grew far faster than the average.

There is also some evidence that tourist use of the Forest may be increasing faster than resident use, as indicated by the steady growth in the sale of nonresident fishing licenses in contrast with constant or declining numbers of resident licenses. This trend is consistent with the observations expressed in some of the key tourism industry interviews, that increasing numbers of nonresidents are “discovering” the Chugach National Forest (Colt et al. in press).

Summary of Recreation Patterns

As the preceding discussions illustrate, understanding the recreation patterns of people is complex. Participation in recreation can be measured in a variety of ways. Different populations recreate in different ways and at different rates. Projecting future recreation behavior assumes that people’s recreation preferences and level of activity will be much like their past behavior. So as a population increases and its demographics change, recreation patterns also change.

As difficult as it may be to measure and project the recreation behavior of a population, there is even less quantitative information available about people’s preferences for recreating in a specific area such as the three geographic areas of the Chugach National Forest.

The following points summarize what is known about recreation behavior at the national and state levels, and on the Chugach National Forest:

- Nationally, statewide, and on the Chugach National Forest, the most popular activities are viewing scenery or sightseeing, viewing fish and wildlife, and social activities such as picnicking or camping. These activities require modest skills and are generally low cost, compared to some of the less popular activities.
- Nationally, we can expect increasing use levels in almost every form of recreation.
- The estimated proportion of Alaskan adults participating in various outdoor recreation activities is generally much higher than for the rest of the U.S. population.
- With a few exceptions, most recreation activities are predicted to increase at about the same rate as overall population growth in Alaska.
- Participation in certain activities may increase at higher rates, due to both increase in the number of Americans in older age groups and the greater participation of those age groups in certain activities. Activities for which enthusiasts are most likely to be over the age of 50 are walking, bird watching, fish and wildlife viewing, sightseeing, and coldwater fishing.

- Visitors to Alaska will outnumber Alaskans in wildlife viewing by almost three to one by 2020. The growth rate for nonresident anglers will also exceed the growth rate for Alaskans by about fifty percent.
- There is ample evidence to suggest that the Chugach National Forest is heavily used as a scenic resource by motorists and waterborne passengers and, increasingly, as a place for road-accessible fishing, camping and motor-assisted recreation.
- Sightseeing generates by far the most of the use on the Chugach National Forest. A distant second is visiting the Forest's two major visitor centers in Portage Valley and Valdez, followed by viewing fish and wildlife.
- Indirect evidence indicates that activities such as whitewater rafting, guided kayaking, guided hiking, snowmachine tours, and helicopter skiing are increasing rapidly on the Chugach National Forest.
- Older age groups participate at a higher rate in less physically demanding activities on the Chugach National Forest, as shown by a higher proportion of people over the age of 45 participating in sightseeing and lower proportion participating in activities such as hiking, biking, and canoeing.
- On the Chugach National Forest, nonresidents engaged in wildlife/fish viewing, sightseeing and going to visitor centers at far higher rates than residents.

Projections of Visits for Chugach National Forest

For the purposes of this environmental analysis, the key question is how well each alternative meets future demand for recreation opportunities on the Chugach National Forest. In the first part of this Affected Environment discussion, the current supply of recreation opportunities on the Chugach National Forest was described in terms of the capacity of developed facilities and the capacity of inventoried settings for dispersed recreation activities. Current use levels were measured by the number of visits occurring at developed facilities and in dispersed settings. In order to evaluate the alternatives' response to future demand, the future number of visits to recreation facilities and settings on the Chugach National Forest must be estimated.

The methodology used to make estimates of future visits to the Chugach National Forest is based on Bowker's (2001) projections of percentage changes in participation times for different recreation activities. Both visits and participation times are measures of frequency. Visits, however, are a measure of use at a location while participation times are not tied to any location. Estimates are made for both Alaskan residents and for visitors to Alaska. The major assumptions used are listed below, with the detailed methodology and assumptions available in the administrative record.

Assumptions:

- Assume visits to Chugach National Forest (1998 INFRA data) will change at the same rate as participation times projected by Bowker and that the projections are uniform across all three geographic areas.
- For Alaska residents, use projections based on the 1997 SCORP data set (Bowker 2001).
- For Alaska visitors, use projections for wildlife/fish related recreation based on the 1996 FHWAR data set (Bowker 2001). For all other activities, use projections based on national the 1995 NSRE data set (Bowker et al. 1999).
- Use data from the Recreation Survey '95 (Reed 1995) to estimate the proportion of resident and nonresident use on Chugach National Forest.

Projections of visits by activity in 2010 were calculated using the following formula:

$$Visits_{2010\ Activity\ X} = (Visits_{1998\ Activity\ X}) \times (P_{2010\ Activity\ X}) \times (R \text{ or } N)$$

where

$Visits_{2010\ Activity\ X}$ is the number of visits to the Chugach National Forest in recreation activity X projected for 2010;

$Visits_{1998\ Activity\ X}$ is the number of visits to the Chugach National Forest in recreation activity X, from INFRA 1998 (cabin and campground visits are based on 2000 use data);

$P_{2010\ Activity\ X}$ is Bowker's projection for percent change in number of times participating for each activity and for residents and nonresidents; and,

R or N is the proportion of Chugach National Forest visitors that are residents or nonresidents.

The results of these calculations are displayed in the last three columns of Table 3-56d.

Table 3-56d: Existing and projected recreation visits to the Chugach National Forest in 2010, by recreation activity.

Recreation Activity	Existing Visits			Projected Visits 2010		
	Developed Sites	Dispersed Areas	Forest Total	Developed Sites	Dispersed Areas	Forest Total
Picnicking	7,152	92,428	99,580	8,186	105,793	113,979
Wildlife/fish Viewing	239,551	566,251	805,801	323,010	763,533	1,086,543
Sightseeing	398,058	3,324,361	3,722,420	497,653	4,156,117	4,653,769
Fishing	25,068	387,058	412,125	30,532	471,436	501,969
Biking	2,317	9,746	12,062	2,713	11,414	14,128
Motorboating	1,242	8,451	9,693	1,361	9,262	10,623
Hiking	37,120	365,126	402,247	44,054	433,332	477,386
Primitive camping	0	167,765	167,765	0	197,963	197,963
ORV, ATV, 4WD	69	38,875	38,944	72	40,508	40,580
Developed camping	163,217	0	163,217	200,985	0	200,985
Cross-country skiing	137,885	54,591	192,477	170,426	67,475	237,901
Snowmachining	121,538	43,045	164,583	144,388	51,137	195,525
Backpacking	0	44,379	44,379	0	51,621	51,621
Hunting	5,467	30,192	35,660	6,879	37,988	44,867
Climbing	0	1,362	1,362	0	1,592	1,592
Berry picking	2,839	45,996	48,835	3,350	54,276	57,626
Canoe/raft/floating	993	9,638	10,631	1,200	11,651	12,851
Visitor Center, nature education	1,512,922	26,262	1,539,184	1,921,411	33,353	1,954,763
Cabins	7,055	0	7,055	7,931	0	7,931
Other	166,306	94,156	260,462	186,117	105,371	291,488
Total	**2,828,799**	**5,309,683**	**8,138,482**	**3,550,269**	**6,603,822**	**10,154,090**

The largest area of uncertainty in this methodology is the lack of comprehensive data regarding visitors' participation in recreation activities while traveling in Alaska, other than for wildlife/fish related activities. People's participation in activities near their residence probably differs from their participation in activities while visiting Alaska. Because people come to Alaska to specifically participate in particular recreation activities, the national data probably underestimates visitors' participation rates in these activities.

Environmental Consequences

The analysis of environmental effects compares the differences in alternatives responding to three primary questions:

1. What are the differences between the current, inventoried ROS Classes and the proposed ROS Classes in each alternative and the differences between alternatives (recreation settings);
2. How will the alternatives respond to anticipated increases in recreation and tourism use for both developed and dispersed recreation opportunities (infrastructure and capacity); and,
3. How will the alternatives improve significant situations related to recreation and user conflicts, primarily winter motorized and nonmotorized recreation opportunities?

These three questions and the factors they address summarize the key indicators that affected development of each alternative. Each alternative emphasizes a different mix of recreation settings, infrastructure and capacity, and reduction of user conflicts consistent with the theme of the alternative. Across the range of alternatives, all the different interests of the Recreation/Tourism Situation are addressed.

Summary of Consequences by Alternative

This section provides a brief description of how each alternative addresses the Recreation/Tourism Situation. An in-depth analysis and comparison of the consequences and effects by geographic area begins after the Summary section.

The Roaded Natural and Roaded Modified ROS classes do not necessarily have roads. Additionally, these ROS classes do not authorize road development. Only management prescriptions can allow road development. Road construction is also limited by the Forest Service's Roadless Area Conservation Rule (see Roadless Areas section). Roads may be an element of the recreation setting in these classes, but the Roaded ROS class also refers to a higher degree of recreation development and comfort such as wide, easy trails; larger numbers of people; facilities for convenience; or, little opportunity for solitude or quiet (Table 3-54).

No Action Alternative

The No Action Alternative allows for opportunities to increase use and development in the Kenai Peninsula and Copper River Delta geographic areas. Prince William Sound emphasizes a wild character and limited development. Recreation settings are primarily Semi-primitive Motorized and Roaded Natural except in Prince William Sound where Semi-primitive Motorized and Primitive II dominate. Few areas are identified to separate motorized and nonmotorized winter or summer recreation activities beyond those currently identified.

Preferred Alternative

The Preferred Alternative allows for opportunities to increase use and development concentrated along existing road corridors (3/4 mile on either side of roads). Prince William Sound and the Copper River Delta geographic areas emphasize dispersed recreation use and limited development. Recreation settings are primarily Primitive, Semi-primitive Nonmotorized and Semi-primitive Motorized away from these corridors. Many areas across the Forest are proposed to be managed to separate motorized and nonmotorized winter and summer recreation activities to reduce user conflicts.

Alternative A

Alternative A allows for opportunities to increase use and development in all geographic areas of the Forest. Recreation settings are primarily Semi-primitive Motorized to Roaded Natural. All geographic areas emphasize motorized recreation activities winter and summer. No areas are designated for nonmotorized settings.

Alternative B

Alternative B allows for opportunities to increase use and development in the Kenai Peninsula and Copper River Delta geographic areas of the Forest. In Prince William Sound, dispersed recreation and limited development are emphasized, except adjacent to Whittier where higher use and development levels are allowed. Recreation settings are primarily Semi-primitive Motorized to Roaded Natural. A few selected areas on the Kenai Peninsula are proposed to be managed to separate motorized and nonmotorized winter and summer recreation activities.

Alternative C

Alternative C allows for opportunities to increase use and development concentrated along existing road corridors (1/2 mile on either side of roads). In Prince William Sound and the Copper River Delta geographic areas, dispersed recreation use and limited development are emphasized. Recreation settings are primarily Semi-primitive Motorized, Semi-primitive Nonmotorized, Roaded Natural, and Roaded Modified. Several selected areas on the Kenai Peninsula are proposed to be managed to separate motorized and nonmotorized winter and summer recreation activities.

Alternative D

Alternative D allows for opportunities to increase use and development concentrated along existing road corridors (1/4 mile on either side of roads). In Prince William Sound, the Copper River Delta, and areas outside the roaded corridors on the Kenai Peninsula geographic areas, dispersed recreation use and limited development are emphasized. Recreation settings are primarily Semi-primitive Motorized and Nonmotorized and Roaded Natural and Modified. Several selected areas on the Kenai Peninsula are proposed to be managed to separate motorized and nonmotorized winter and summer recreation activities.

Alternative E

Alternative E allows for opportunities to increase use and development concentrated along existing road corridors (1/4 mile on either side of road). In Prince William Sound, the Copper River Delta, and areas outside the roaded corridors on the Kenai Peninsula geographic areas, dispersed recreation use and limited development are emphasized. Recreation settings are primarily Primitive to Semi-primitive Motorized. Much of the Kenai Peninsula geographic area emphasizes nonmotorized recreation activities winter and summer. Prince William Sound and the Copper River Delta have selected areas separating motorized and nonmotorized winter and summer recreation activities.

Alternative F

Alternative F allows for opportunities to increase use and development concentrated along existing road corridors (1/4 mile on either side of road). In Prince William Sound, the Copper River Delta, and areas outside the roaded corridors on the Kenai Peninsula geographic areas, dispersed recreation use and limited development are emphasized. Recreation settings are primarily Primitive to Semi-primitive Nonmotorized. All geographic areas emphasize nonmotorized

recreation activities winter and summer, so no areas are designated for motorized settings.

Environmental Consequences by Geographic Area

Allocation of prescriptions and management intent varies for each geographic area by alternative. In-depth analysis of the environmental consequences of the alternatives are discussed and displayed by the three major geographic areas of the Chugach National Forest: Kenai Peninsula, Prince William Sound and Copper River Delta. This analysis will address the three major topics identified as key indicators:

1. Recreation Settings, discussed in two parts:
   - The difference between the existing ROS classes and the ROS classes proposed in each alternative will be described. Any difference indicates how much the recreation settings may migrate from current settings over the life of the plan.
   - The alternatives will be compared to each other as to the relative differences in recreation settings and opportunities. Tables and figures will be included to display the specific acres in each class.
2. Recreation Infrastructure and Capacity, discussed in two parts:
   - The existing developed recreation infrastructure and capacity and the alternatives' proposed developed infrastructure and capacity will be compared and discussed.
   - The existing dispersed recreation capacity and the alternatives' proposed dispersed capacity will be compared and discussed.
3. Recreation conflicts and situations are discussed relative to the conflict or situations of each geographic area, comparing the alternatives on how specific conflicts or situations were addressed in the alternatives.

The recreation settings are discussed and displayed without reference to their motorized component. The ROS classes are grouped into Primitive, Semi-primitive, and Roaded. Interests related to access and motorized use or activities will be discussed in the third section of each geographic area (user conflicts) and the section on Access Management.

For all alternatives and geographic areas the Rural ROS class is used only on mineral claims and will remain constant. This ROS is proposed for mineral claims assuming that there will be a certain level of disturbance and the recreation setting will be altered. It will not be discussed or analyzed further.

Kenai Peninsula Geographic Area

On the Kenai Peninsula, there is an existing infrastructure and access network. The alternatives for Kenai Peninsula provide Primitive and Semi-primitive recreation settings accessible from the road corridor, allow development of

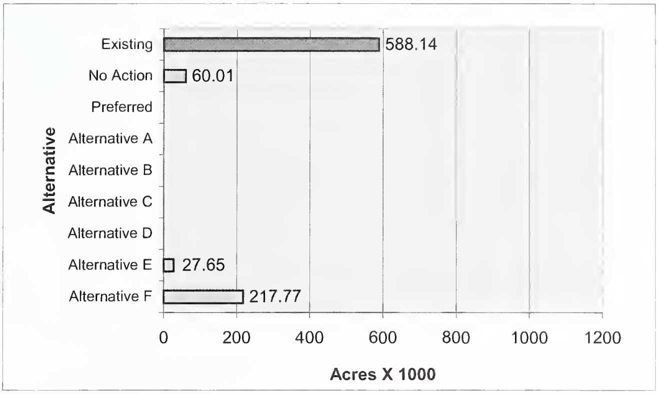
infrastructure to meet anticipated demand for more recreation infrastructure and capacity, and address conflicts between winter and summer motorized and nonmotorized interests.

Recreation Settings

All the alternatives emphasize intense recreation management along the Seward Highway All-American Road corridor. The ROS class is Roaded Natural except in those areas where forest restoration is emphasized and the ROS class is Roaded Modified. While all alternatives propose to manage the road corridor similarly, there is a difference in the width of the road corridor. Alternative A has a 1-mile corridor on either side of the road. The Preferred Alternative has a ¾ mile corridor on either side. Alternatives B, C and the No Action Alternative have a ½ mile corridor on either side and Alternatives D, E, and F have a ¼ mile corridor. In all alternatives, this would allow for development of a variety of recreation facilities and infrastructure to accommodate anticipated increases in use. Within the road corridor, Forest visitors should not expect to find much quiet or solitude. Access would be relatively easy and never too far away. The only difference in the corridor width is in the land area available, along the road corridor, where more intense management can occur. The greatest variance between the existing ROS settings and the proposed ROS settings in the alternatives is the allocation of recreation settings away from the Seward Highway All-American Road corridor.

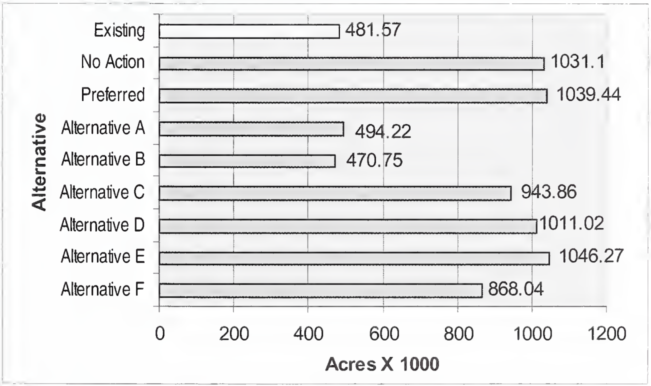
In all alternatives, the Primitive ROS class would not be emphasized (Figure 3-60a). The existing opportunities for primitive recreation opportunities would not be managed for in Alternatives A, B, C, D, and the Preferred Alternative. Alternative E has a small primitive area at the head of the Snow River; the No Action Alternative has a slightly larger area also in the Snow River drainage; and Alternative F maintains most of the Snow River, South Fork Snow River, Lost Lake and Russian River drainage for primitive recreation opportunities.

Figure 3-60a: Primitive ROS by alternative - Kenai Peninsula.



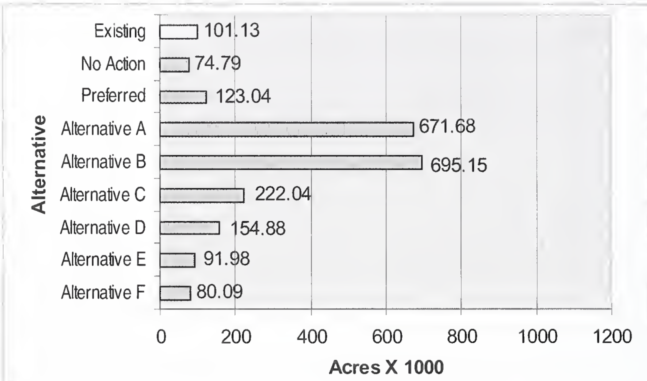
For the Kenai Peninsula geographic area, Semi-primitive recreation settings are the primary management emphasis in all alternatives except Alternatives A and B (Figure 3-60b). Alternatives A and B maintain approximately the same amount of Semi-primitive recreation opportunities as currently existing. Most of the areas proposed for Semi-primitive management are currently inventoried as Primitive. Managing for a Semi-primitive recreation setting would allow the Forest to maintain the wild and natural character of most of the Kenai Peninsula while also improving access (primarily trails) and developing additional recreation sites (cabins, viewing areas, etc.).

Figure 3-60b: Semi-primitive ROS by alternative - Kenai Peninsula.



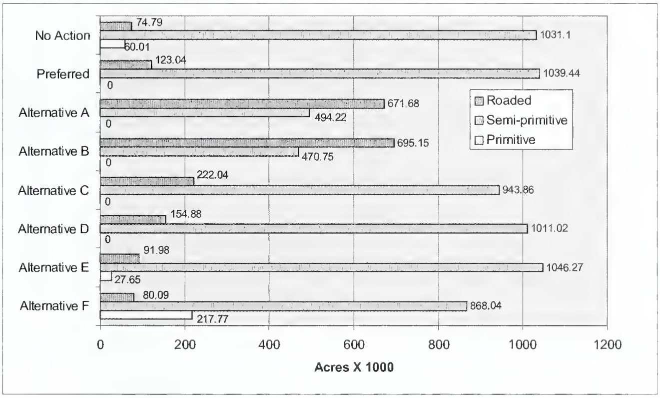
Only Alternatives A and B propose any significant change from the existing Roaded ROS classes (Figure 3-60c). Both Alternatives A and B propose that large areas of the Kenai Peninsula be managed for Roaded ROS opportunities. Most of the areas proposed for Roaded ROS management are currently inventoried Primitive and Semi-primitive. Managing for a Roaded recreation setting would allow the Forest to significantly increase the density of recreation use and activities, develop a variety of facilities, and improve access.

Figure 3-60c: Roaded ROS by alternative - Kenai Peninsula.



In comparing the alternatives, there is not a significant variation in the proposed recreation settings, except for Alternatives A and B (Figure 3-60d). All but Alternatives A and B emphasize Semi-primitive recreation settings for most of the Kenai Peninsula, with Roaded settings concentrated along the road corridors. This would result in a concentration of recreation use, facilities and activities along the road corridors while maintaining a more natural setting away from the road corridors. Opportunities to experience Alaska from easier, road accessible sites would be available as well as opportunities for those interested in getting away from more crowded and developed areas. Alternatives A and B emphasize more Roaded recreation settings, allowing for higher recreation use and development over a much larger area. This higher level of use and development can only be achieved with improvements in access including construction of new roads and trails. The result would be a significant increase in recreation opportunities for people with limited means or skill to experience Alaska. Only Alternative F proposes to maintain any significant amount of Primitive recreation opportunities on the Kenai Peninsula.

Figure 3-60d: ROS settings by alternative – Kenai Peninsula.



Recreation Infrastructure and Capacities

In all alternatives, the allocation of management prescriptions on the Kenai Peninsula geographic area are designed to be most responsive to the need for increases in recreation infrastructure and capacity. All of the alternatives allow for development of recreation facilities and infrastructure. Alternatives C, D, E, F, the No Action Alternative, and the Preferred Alternative focus development of facilities within the existing road corridor. Only Alternatives A and B allow for development outside the existing road corridor. Table 3-57a displays the proposed number of facilities that may be developed on the Kenai Peninsula.

Table 3-57a: Developed recreation facilities by alternative – Kenai Peninsula.

		Alternative							
	Existing	No Action	Preferred	A	B	C	D	E	F
CAMPGROUNDS									
PAOT-days	577,297	617,857	600,957	617,857	617,857	617,857	607,717	597,577	597,577
No. of campgrounds	14	18	17	18	18	18	17	16	16
No. of campsites (within campgrounds)	415	655	555	655	655	655	595	535	535
No. of campsites available during annually	44,172	79,692	64,892	79,692	79,692	79,692	70,812	61,932	61,932
CABINS									
PAOT-days	43,380	61,380	54,180	58,980	58,980	61,380	61,380	58,980	51,780
No. of cabins	19	34	28	32	32	34	34	32	26
No. of cabin nights available annually	5,844	9,594	8,094	9,094	9,094	9,594	9,594	9,094	7,594
DAY USE SITES									
PAOT-days	549,719	562,819	569,269	582,169	562,819	562,819	549,719	549,719	549,719
No. of sites	17	20	20	24	20	20	17	17	17
TRAILHEADS									
PAOT-days	44,272	142822	166,912	186,622	223,852	196,477	149,392	111,067	90,262
No. of trailheads	18	26	32	30	33	31	30	26	24

In addition to facilities, new access routes that open areas currently difficult to access without special equipment or skill, are allowed in all alternatives (Table 3-57b). All of the alternatives propose to increase the miles of trail on the Kenai Peninsula. Only Alternative B proposes any roads solely to provide recreation access to areas currently unroaded. All the alternatives propose roads associated with recreation facility development or resource extraction (primarily timber management).

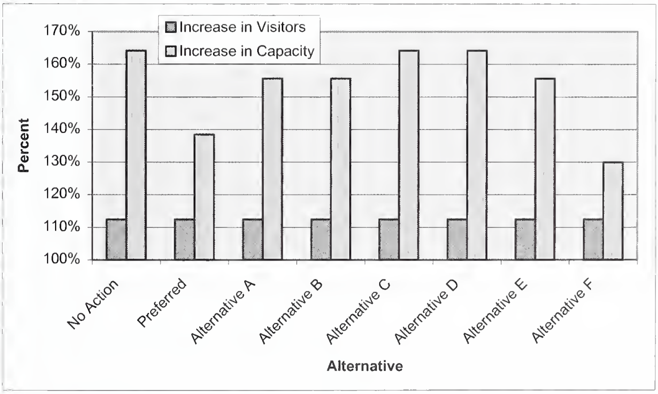
Table 3-57b: Total trails and road miles by alternative – Kenai Peninsula.

	Existing	No Action	Preferred	A	B	C	D	E	F
Miles of Trail	345	412	504	461	447	489	489	431	390
Miles of New Road (not associated with rec site development or timber management)	0	0	0	16	0	0	0	0	
Miles of New Road (associated with rec site development)	19	0	27	25	24	11	11	9	
Miles of New Road (associated with timber management)	13	0	15	9	0	0	0	0	

For developed recreation opportunities, all the alternatives would increase the available capacity. This is most critical for cabins and campgrounds, both of which are at or near capacity (see Affected Environment this section).

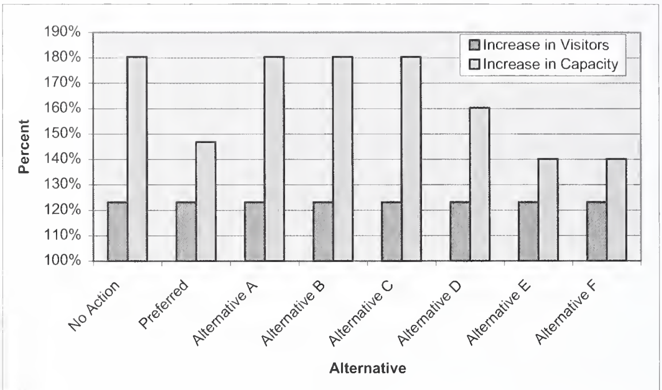
For recreation cabins, all the alternatives would allow building more cabins on the Kenai Peninsula. Based on the themes of the alternatives, Alternatives C, D and the No Action Alternative propose the most cabins, and Alternative F the fewest. Figure 3-60e shows the percent increase in cabin capacity in relation to the projected increase in cabin use. All alternatives project that capacity would exceed the projected demand by the Year 2010. The Kenai Peninsula cabins are already heavily used and at capacity. They are often reserved well in advance which may indicate that there may be an unfulfilled demand for cabins that is not reflected in the projected use. As a result, the excess capacity shown in Figure 3-60e may actually be less.

Figure 3-60e: Projected cabin capacity vs. projected cabin use – Kenai Peninsula.



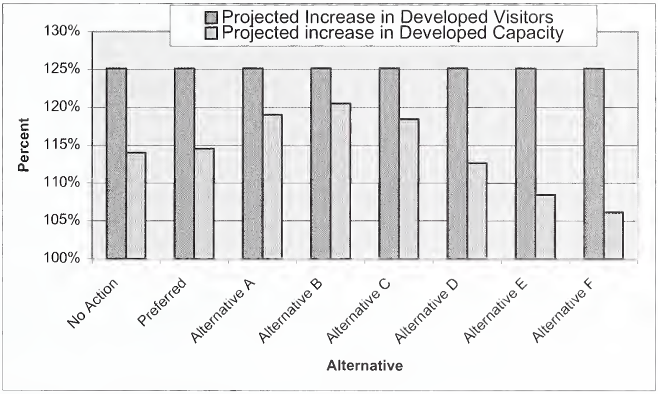
All of the alternatives also propose increasing the campground capacity. Alternatives propose developing two to four campgrounds with 120 to 240 individual camping units. Projections show camping use to be increasing. Based on current occupancy and crowding at campgrounds and projections for camping use, the addition of two to four campgrounds would meet the demand by the year 2010 (Figure 3-60f).

Figure 3-60f: Projected camping capacity vs. projected camping use – Kenai Peninsula.



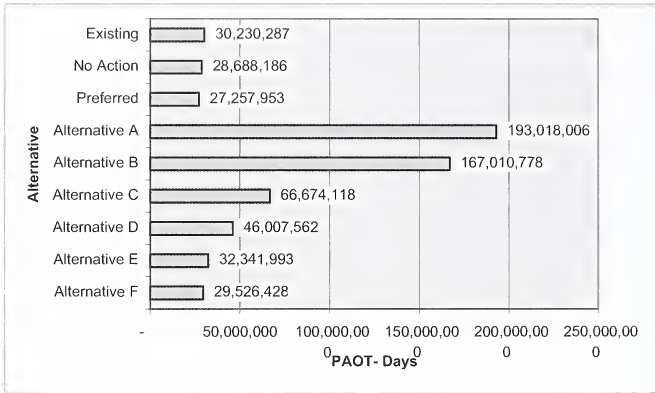
Overall, the projections for developed recreation use do indicate that demand for developed recreation opportunities and facilities would grow faster than the capacity in all alternatives. Alternative B most closely responds to the projected demand (Figure 3-60g). This is a little misleading because there is currently an excess capacity in the developed recreation infrastructure (not including cabins or campgrounds) on the Kenai Peninsula of 10 to 20 percent (USDA Forest Service 1998c). The current excess capacity combined with additional capacity proposed should make the difference much less. Considering that, Alternatives A, B and C should meet expected use in the year 2010. All the other alternatives would be close to meeting demand. This assessment does not consider any increases in capacity by other landowners or private businesses.

Figure 3-60g: Developed recreation capacity vs. projected use – Kenai Peninsula.



Dispersed recreation opportunities and capacities vary between alternatives. Alternatives A and B have the highest capacities because of the high proportion of Roaded ROS settings throughout the Kenai Peninsula. The Roaded ROS class has a much higher capacity than other ROS classes. All the other alternatives have a much lower capacity because only the road corridor is proposed for higher density recreation use (Figure 3-60h). In all alternatives, developed recreation capacity is in addition to the dispersed capacity.

Figure 3-60h: Dispersed recreation capacity – Kenai Peninsula.



Recreation Conflicts and Situations

The major conflict or situation addressed in the alternatives for the Kenai Peninsula geographic area is the allocation of winter season motorized and nonmotorized activities, and to a lesser degree, the summer season.

Winter motorized and nonmotorized allocations have been one of the most controversial topics of the Forest Plan revision. Many of the alternatives were specifically designed to allow or restrict motorized and nonmotorized uses on the Kenai Peninsula to provide separation of the uses.

The major factor surrounding the motorized and nonmotorized situation is noise. Additionally, there is an incompatibility of motorized and nonmotorized uses perceived by some users, especially the nonmotorized users. Issues surrounding this difference are safety concerns, speed of machines and air pollution in wildland settings. Some of this is simply a basic, gut-level value held by individuals desiring nonmotorized opportunities without the presence of any motorized activities. As motorized uses have expanded, there has been a certain amount of displacement of nonmotorized users from areas traditionally used.

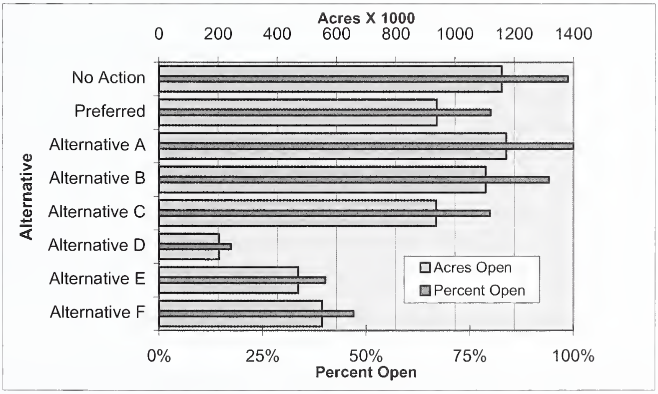
Many factors contribute to noise. The loudness, duration, and type of noise determine if a sound will be annoying or background. For helicopters, it is the main rotor blades responsible for much of the sound. The "blade slap" is the most disturbing component of the noise due to its impulsive nature and because it occurs in the mid-frequency range where human hearing is most sensitive. With snowmachines, it is often the continuous or near continuous revving of the engines that create the noise that annoys people.

A number of other factors can influence the loudness of sound. Distance from the sound source affects the intensity. The atmosphere absorbs some sound. Other environmental factors can influence sound intensity or duration including wind, terrain, and vegetation. A Forest Service study concluded that the sound levels from helicopters do not pose a threat to hearing safety (USDA Forest Service 1994). The snowmachine industry has adopted standards to limit the noise of snowmachines when they leave the factory.

The only acoustic impact to people resulting from helicopter or snowmachine sounds is that of annoyance to those who reside near helicopter or snowmachine travel routes or who recreate in backcountry areas where natural quiet is a primary component of the recreation experience. Any contact with snowmachines or helicopters may spoil their experience.

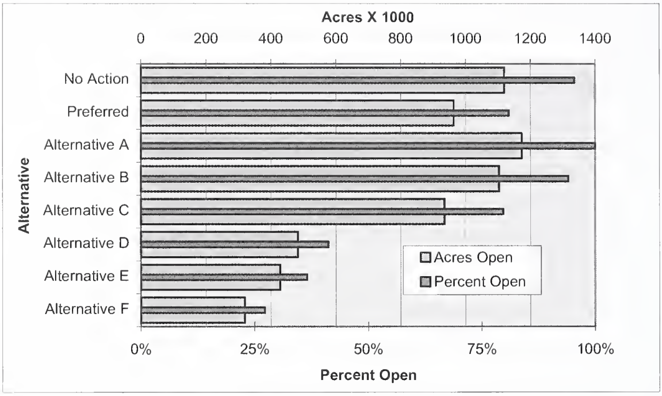
Winter snowmachine use is generally allowed in all alternatives. All of the alternatives, except Alternative A, identify specific areas of varying size that are closed to motorized uses (Figures 3-60i and 3-60j). Refer to Appendix H of the FEIS and the alternative maps for descriptions of specific areas that are closed to motorized use under each alternative.

Figure 3-60i: Acres available for winter snowmachine activity - Kenai Peninsula.



Winter helicopter access for heli-skiing is similar to snowmachine use. There are some slight differences, especially in the Preferred Alternative and Alternatives D and F. Alternatives D and the Preferred Alternative allocate slightly more area for helicopter access while Alternative F allocates slightly less for helicopter access.

Figure 3-60j: Acres available for winter helicopter activities – Kenai Peninsula.



Prince William Sound Geographic Area

Prince William Sound is wild and undeveloped. There is no developed infrastructure and only limited recreational facilities on National Forest System lands. The proposed alternatives for the Prince William Sound geographic area provide for the Primitive and Semi-primitive recreation settings of the Prince William Sound and allow limited development at nodes to meet anticipated demand for more recreation infrastructure and capacity. This demand is expected to result from the new road access to Whittier and increased services based in Valdez, Cordova, and Whittier, facilitating people's recreation in the Prince William Sound.

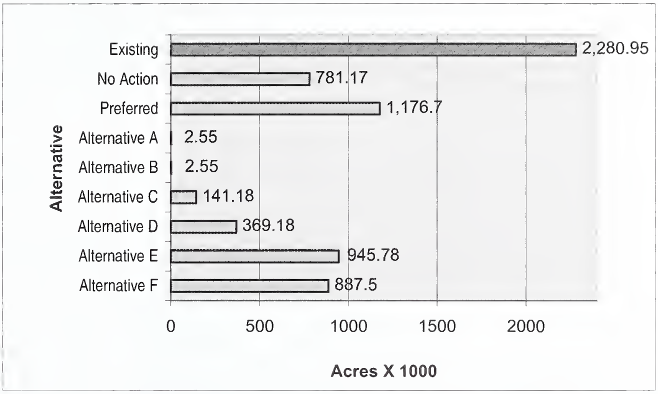
Note: The following analysis assumes alternatives are implemented as designed by the Revised Forest Plan, including the recommended prescriptions for the Nellie Juan-College Fiord Wilderness Study Area. The Wilderness Study Area will be managed under Forest Service regional manual direction to protect wilderness character until Congress considers the Wilderness Study.

Recreation Settings

All the alternatives, except Alternatives A and B, emphasize dispersed recreation management throughout the Sound with ROS classes of Primitive and Semi-primitive. In Alternatives A and B the ROS classes are Roaded and Semi-primitive.

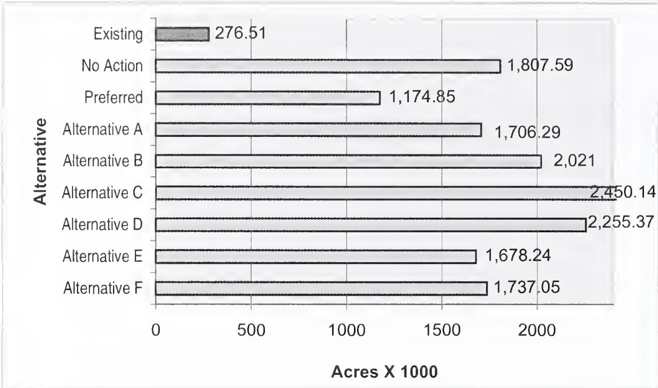
Under all of the alternatives, the quantity of Primitive ROS settings found currently in the Prince William Sound would not be managed at the existing level (Figure 3-61a). Alternatives E, F, the No Action Alternative, and the Preferred Alternative propose continued management of 35 to 51 percent of the existing Primitive settings over large areas of Prince William Sound. Alternative C proposes one area in the Primitive ROS class at the head of Unakwik Inlet. Alternative D has three Primitive ROS areas: Icy Bay, Kings Bay and Unakwik Inlet. No Primitive ROS opportunities would be provided under Alternatives A and B, except on Green Island.

Figure 3-61a: Primitive ROS by alternative - Prince William Sound.



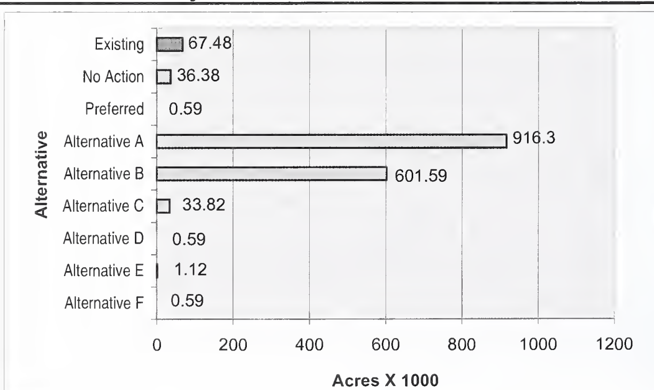
In the Prince William Sound geographic area, semi-primitive recreation settings are the primary management emphasis in all alternatives except Alternatives A and B (Figure 3-61b). All the alternatives propose to increase management for Semi-primitive recreation opportunities. Most of the areas proposed for Semi-primitive management are inventoried as Primitive ROS settings. All of the alternatives, except Alternatives A and B, proposed managing for Semi-primitive recreation settings for varying distances or radii from major entry points to the Sound (Whittier, Valdez and Cordova). Managing for a Semi-primitive recreation opportunity in combination with the proposed Primitive management (except Alternatives A and B) would allow the Forest to maintain the wild and natural character of most of Prince William Sound while also improving access (primarily trails) and developing additional recreation sites (cabins, viewing areas, etc.). Alternatives A and B propose to manage several large areas of the Sound for Semi-primitive recreation opportunities in combination with Roaded settings. The Semi-primitive settings are located away from the major entry points to the Sound, with Roaded recreation settings proposed for areas near the entry points.

Figure 3-61b: Semi-primitive ROS by alternative – Prince William Sound.



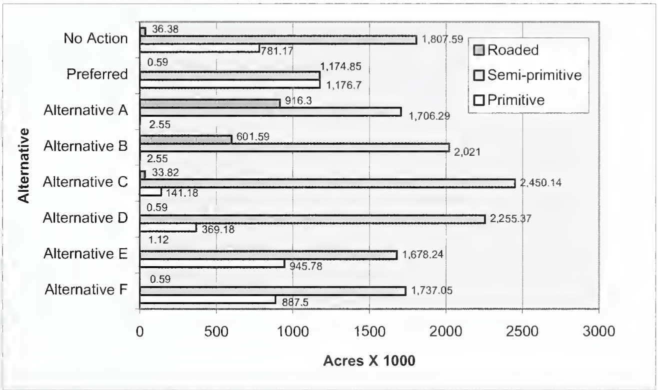
Only Alternatives A and B propose any significant change from the existing Roaded ROS classes (Figure 3-61c). Both Alternatives A and B propose that large areas of Prince William Sound be managed for Roaded ROS opportunities. Most of the areas proposed for Roaded ROS management are currently inventoried as Primitive. Both alternatives propose management of the major portals to the Sound for Roaded recreation opportunities. Managing for a Roaded recreation setting would allow the Forest Service to significantly increase the density of recreation use and activities, develop a variety of facilities, and improve access.

Figure 3-61c: Roaded ROS by alternative – Prince William Sound.



In comparing the alternatives, there is not a significant variation in the proposed recreation settings, except for Alternatives A and B (Figure 3-61d). All but Alternatives A and B emphasize a mix of Primitive and Semi-primitive recreation settings for most of Prince William Sound. This approach would maintain the current emphasis on dispersed recreation use, facilities, and activities throughout the Sound, maintaining its wild character. Some outdoor skills and knowledge will be required to experience this wild Alaska and some may choose to participate through the use of permitted outfitters and guides and other commercial recreation service opportunities. Alternatives A and B emphasize a mix of Semi-primitive and Roaded recreation settings, allowing for higher recreation use and development over a much larger area, especially adjacent to the major portals to the Sound. Facilities for larger groups and higher densities of people would be allowed. This higher level of use and development can only be achieved with improvements in access. This approach would result in a significant increase in recreation opportunities for people with limited means or skill to experience Alaska.

Figure 3-61d: ROS settings by alternative – Prince William Sound.



<u>Recreation Infrastructure and Capacities</u>

All of the alternatives are responsive to the need for increases in recreation infrastructure and capacity in Prince William Sound. Alternatives A and B meet this need by including large areas in the Roaded ROS class, which allows for construction of developed recreation facilities and high levels of visitors. The other alternatives make use of two approaches that allow for more development in otherwise dispersed settings: the Backcountry Groups prescription and the Semi-primitive Groups ROS class. The Backcountry Groups prescription allows development nodes in which services and facilities would be provided in backcountry settings. The Semi-primitive Groups ROS class allows for limited

areas of concentrated visitor use and limited facilities. Table 3-57c displays the proposed number of facilities that may be developed in Prince William Sound.

Table 3-57c: Developed recreation facilities by alternative - Prince William Sound.

		Alternative								
	Existing	No Action	Preferred	A	B	C	D	E	F
CAMPGROUNDS									
PAOT-days	0	0	0	0	0	0	0	0	0
No. of campgrounds	0	0	0	0	0	0	0	0	0
CABINS									
PAOT-days	33,766	50,566	52,966	62,566	62,566	61,366	55,366	50,566	36,166
No. of cabins	16	30	32	40	40	39	34	30	18
No. of cabin nights available annually (340 day managed season)	3,288	6,088	6,488	8,088	8,088	7,888	6,888	6,088	3,688
DAY USE SITES									
PAOT-days	11,900	11,900	12,975	14,050	12,975	11,900	11,900	11,900	11,900
No. of sites	1	1	2	3	2	1	1	1	1
TRAILHEADS									
PAOT-days	0	0	8,600	0	0	0	0	0	0
No. of trailheads	0	0	3	0	0	0	0	0	0
DEVELOPMENT NODES/SITES									
Backcountry Groups Prescription	0	0	2	0	0	18	0	0	0
Semi-primitive Groups ROS Class	0	0	0	0	0	10	4	3	4

Source: USDA Forest Service 1998 INFRA database (USDA Forest Service 1998c).

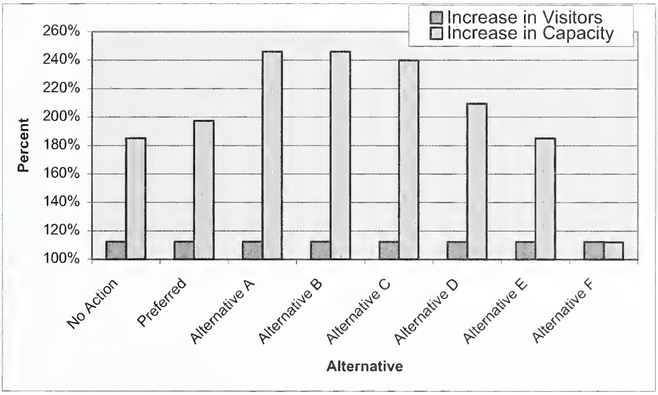
In addition to facilities, new trails that open areas currently difficult to access without special equipment or skill are allowed in all alternatives. All of the alternatives propose to increase the miles of trail in Prince William Sound. No roads are proposed in any alternative solely to provide recreation access. Alternatives A, B and the No Action Alternative propose roads associated with resource extraction (primarily timber management) (Table 3-57d).

Table 3-57d: Total trails and road miles by alternative - Prince William Sound.

		Alternative							
	Existing	No Action	Preferred	A	B	C	D	E	F
Miles of Trail	69	99	146	169	194	193	155	106	97
Miles of New Road (not associated with recreation site development or timber management)		1	1	1	1	1	1	1	1
Miles of New Road (associated with rec site development)		0	0	0	0	0	0	0	0
Miles of New Road (associated with timber management)		22	0	32	21	0	0	0	0

All the alternatives would allow building more cabins in Prince William Sound. Based on the themes of the alternatives, Alternatives A, B and C propose the most cabins, and Alternative F the fewest. Figure 3-61e shows the percent increase in cabin capacity in relation to the projected increase in cabin use. Cabin capacity under all alternatives except Alternative F would exceed the projected demand by 2010. Existing cabins in western Prince William Sound are already used at capacity. They are often reserved well in advance which may indicate unfulfilled demand for cabins that is not reflected in the projected use. As a result, the difference between the projected capacities shown in Figure 3-61e may actually be less.

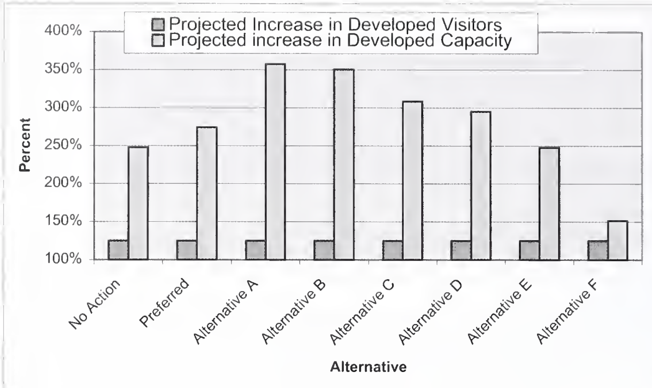
Figure 3-61e: Projected cabin capacity vs. projected cabin use – Prince William Sound.



No new developed campgrounds are proposed in Prince William Sound. Increased camping capacity is proposed as hardened, dispersed campsites. These new campsites are included in the dispersed recreation discussion that follows.

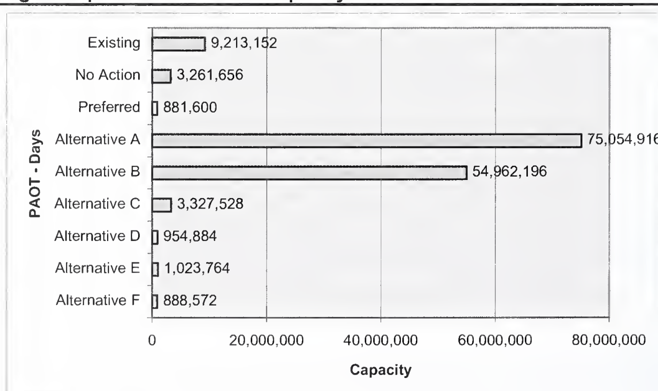
Overall, the projections indicate the demand for developed recreation opportunities and facilities would be met by the projected capacity in all alternatives. Alternative A, B, and C would have the highest excess capacity, Alternative F the least (Figure 3-61f). This result may be somewhat misleading, however, because there is currently a shortage in capacity, especially in western Prince William Sound. Also, because the emphasis is on dispersed recreation opportunities in Prince William Sound, the only increase in developed capacity is in recreation cabins. Additional developed capacity that may occur at development nodes (Backcountry Groups prescription and Semi-primitive Groups ROS) is not shown. This assessment does not consider any increases in capacity by other landowners or private businesses.

Figure 3-61f: Developed recreation capacity vs. projected use – Prince William Sound.



Dispersed recreation opportunities and capacities vary between alternatives. Alternatives A and B have the highest capacities because of the high proportion of Roaded ROS settings throughout Prince William Sound. The Roaded ROS Class has a much higher capacity than other ROS classes. All the other alternatives have a much lower capacity because of the emphasis on Primitive and Semi-primitive recreation settings (Table 3-61g). In all alternatives, developed recreation capacity is in addition to the dispersed capacity.

Figure 3-61g: Dispersed recreation capacity – Prince William Sound.



Recreation Conflicts and Situations
The major conflict or situation addressed in the alternatives for the Prince William Sound geographic area is the allocation of prescriptions and recreation settings in response to potential changes in use as a result of improved access to Whittier.

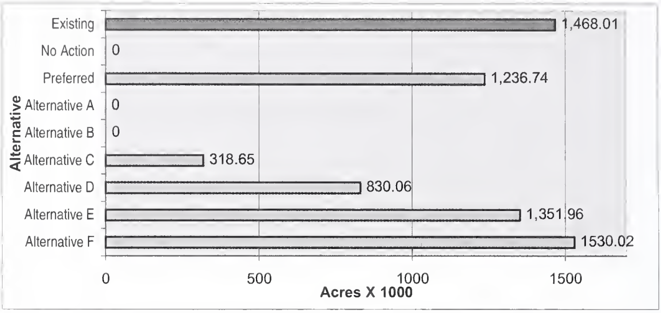
Many of the alternatives were specifically designed to allow for more intense recreation management within a “weekend radius” of Whittier and, to a lesser extent, Valdez and Cordova. Alternatives A and B, in particular, allocate Roaded ROS classes in the weekend radius. This approach would allow for higher density recreation use and development over broad areas of the western Sound. The other alternatives allocate Semi-primitive ROS classes in this weekend radius, but also identify varying numbers of nodal development points. This approach maintains a generally undeveloped character in the Sound, but allows for notes of concentrated developed recreation to serve increased demand.

Copper River Delta Geographic Area
Except for a narrow corridor along the 50-mile long Copper River Highway from Cordova to the Million Dollar Bridge, the Copper River Delta geographic area is wild and undeveloped. Limited developed infrastructure exists in this road corridor, and very limited recreational facilities, mostly recreational cabins, away from the road. The alternatives for the Copper River Delta geographic area emphasize management for the Primitive and Semi-primitive recreation settings of the Delta with higher intensities of management and development along the road corridor.

Recreation Settings
All the alternatives propose dispersed recreation management throughout the Copper River Delta geographic area, except along the road corridor. More intense management for developed recreation is proposed in the road corridor, ranging from ½ mile to ¼ mile on either side of the Copper River Highway. The ROS classes proposed in all alternatives are Primitive and Semi-primitive except in Alternative B, where a large area north of the Copper River Highway is proposed for Roaded ROS class management.

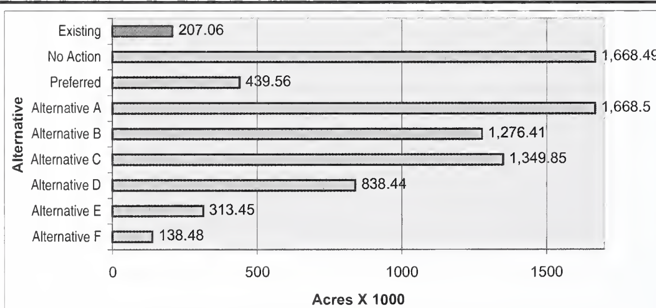
The alternatives range widely in their proposed management of the existing quantity of Primitive ROS settings found on the Delta (Figure 3-62a). Alternative F proposes to increase Primitive management slightly compared to existing, and Alternatives E and the Preferred Alternative propose to maintain 75 to 85 percent of the existing Primitive settings over large areas of the Delta. Alternative D proposes a large area for Primitive management on the southeast Delta and Alternative C has an area on the northeast Delta. Alternatives A, B, and the No Action Alternative would not maintain any Primitive ROS opportunities.

Figure 3-62a: Primitive ROS by alternative – Copper River Delta.



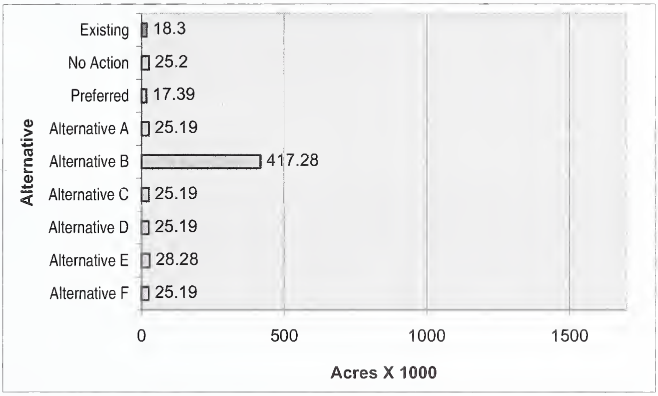
In the Copper River Delta geographic area, all the alternatives propose to increase management for Semi-primitive recreation opportunities over existing levels (Figure 3-62b). Most of these Semi-primitive settings would come from existing Primitive settings, where management would allow the setting to move from the existing very dispersed and undeveloped character to one allowing facilities at a slightly higher density and number. This migration from Primitive to Semi-primitive recreation settings is greatest in Alternatives A, B, C, D, and the No Action Alternative.

Figure 3-62b: Semi-primitive ROS by alternative – Copper River Delta.



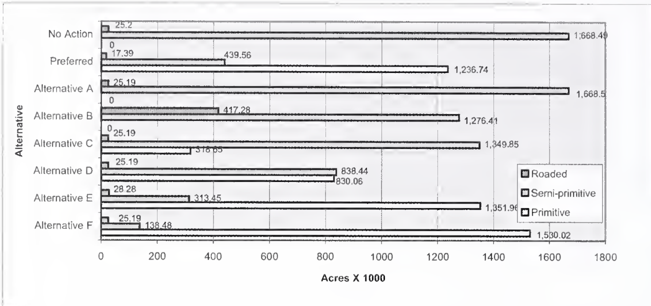
Only Alternative B proposes any significant change from the existing Roaded ROS classes (Figure 3-62c). Alternatives B propose that a large area north of the Copper River Highway be managed for Roaded ROS opportunities. Most of the area proposed for Roaded ROS management is currently inventoried Primitive. Managing for a Roaded recreation setting allows for significant increases in the density of recreation use and activities.

Figure 3-62c: Roaded ROS by alternative – Copper River Delta.



Of the three geographic areas, the Copper River Delta has the greatest variation in recreation settings between alternatives (Figure 3-62d). All the alternatives propose a mix of Primitive and Semi-primitive recreation settings for most of the Copper River Delta. It is the proportion of Primitive to Semi-primitive that swings widely, from a nearly 1:1 ratio (Alternative D) to an 11:1 ratio (Alternative F). Alternative A, B, and the No Action Alternative emphasize management for Semi-primitive recreation settings, with no Primitive settings. Overall, the Primitive and Semi-primitive recreational opportunities of the Copper River Delta would be maintained in all alternatives, continuing the current emphasis on dispersed recreation use, facilities, and activities away from the Copper River Highway. Experiencing a wilder Alaska requires some outdoor skill and knowledge. Only Alternative B emphasizes a mix of Semi-primitive and Roaded recreation settings, allowing for higher recreation use and development over a much larger area. Facilities for larger groups and higher densities of people would be allowed. This higher level of use and development can only be achieved with improvements in access, resulting in a significant increase in recreation opportunities for people with limited means or skill to experience Alaska.

Figure 3-62d: ROS settings by alternative – Copper River Delta.



Recreation Infrastructure and Capacities

In all alternatives except Alternatives B, the allocation of management prescriptions in the Copper River Delta geographic area are designed to continue the emphasis on dispersed recreation opportunities away from the Copper River Highway. Alternative B has a mix of dispersed and developed recreation opportunities. All of the alternatives are responsive to the need for increases in recreation infrastructure and capacity along the Copper River Highway. All of the alternatives allow for some development of recreation facilities and infrastructure. Table 3-57e displays the proposed number of facilities that may be developed in the Copper River Delta geographic area.

Table 3-57e: Developed recreation facilities by alternative - Copper River Delta.

		Alternative								
	Existing	No Action	Preferred	A	B	C	D	E	F
CAMPGROUNDS									
PAOT-days	3,825	20,725	20,725	20,725	20,725	20,725	20,725	20,725	20,725
No. of campgrounds	1	1	1	1	1	1	1	1	1
No. of campsites (within campgrounds)	5	25	25	25	25	25	25	25	25
No. of campsites available annually (196 day managed season)	1,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
CABINS									
PAOT-days	16,434	20,034	21,234	23,634	23,634	23,634	21,234	18,834	16,434
No. of cabins	8	11	12	14	14	14	12	10	8
No. of cabin nights available annually (340 day managed season)	1,129	1,729	1,929	2,329	2,329	2,329	1,929	1,529	1,129
DAY USE SITES									
PAOT-days	77,646	77,646	86,246	81,946	81,946	77,646	77,646	77,646	77,646
No. of sites	13	13	16	14	14	13	13	13	13
TRAILHEADS									
PAOT-days	33,072	37587	43,062	43,062	43,062	43,062	43,062	43,062	37,587
No. of trailheads	9	10	11	11	11	11	11	11	10

Source: USDA Forest Service 1998 INFRA database (USDA Forest Service 1998c).

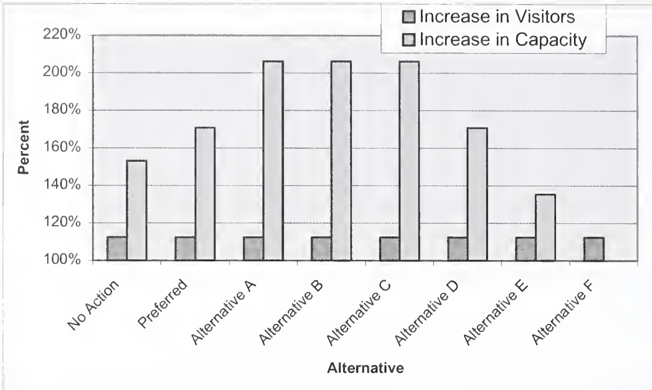
In addition to facilities, new trails that open areas currently difficult to access without special equipment or skill are allowed in all alternatives. All of the alternatives propose to increase the miles of trail in the Copper River Delta (Figure 3-57f). No roads are proposed in any alternative solely to provide recreation access. All the alternatives propose roads associated with recreation site development and Alternatives A, B and the No Action Alternative propose new roads for resource extraction (primarily timber management).

Table 3-57f: Total trails and road miles by alternative - Copper River Delta.

		Alternative							
	Existing	No Action	Preferred	A	B	C	D	E	F
Miles of Trail	66	122	122	134	146	151	133	124	108
Miles of New Road (not associated with rec site development or timber management)		0	0	0	0	0	0	0	0
Miles of New Road (associated with rec site development)		3	7	5	5	4	4	4	3
Miles of New Road (associated with timber management)		9	0	34	4	0	0	0	0

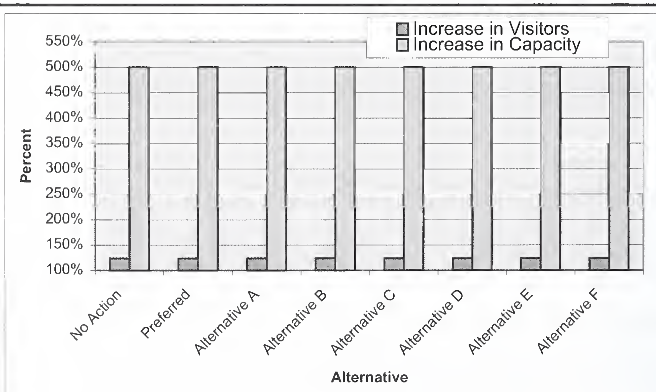
The Copper River Delta has limited developed recreation opportunities away from the Copper River Highway. All the alternatives would allow building of over night camping facilities along the highway corridor and more cabins throughout the Copper River Delta. Based on the themes of the alternatives, all the alternatives, except Alternative F, propose two to six new cabins. Alternative F proposes no new cabins. Figure 3-62e shows the percent increase in cabin capacity in relation to the projected increase in cabin use. Capacity under all alternatives except Alternative F would exceed the projected demand by the year 2010.

Figure 3-62e: Projected cabin capacity vs. projected cabin use – Copper River Delta.



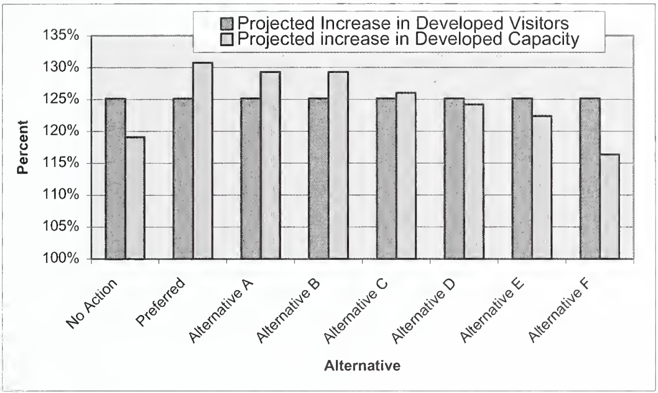
All the alternatives propose one new developed campground on the Copper River Delta. There are currently only five developed camping sites on the Delta and have relatively low use. Figure 3-62f shows the proposed capacity greatly exceeding the projected demand for overnight camping. This result is misleading in that the existing sites are for walk-in camping and a full-service campground is proposed. Such a facility is expected to attract much higher use than currently experienced. Also, a road or trail to Chitna and additional recreation development along the Copper River Highway would attract more people.

Figure 3-62f: Projected camping capacity vs. projected camping use – Copper River Delta.



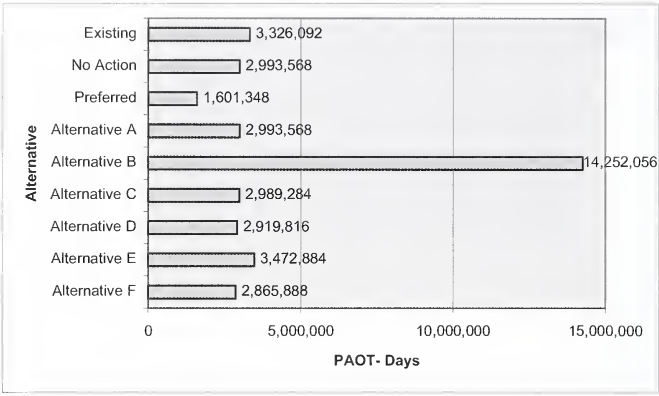
Overall, projections indicate the demand for developed recreation opportunities and facilities will be close to the projected capacity in Alternatives C and D; projected demand would exceeded projected capacity slightly in Alternatives E, F and the No Action Alternative; and, projected capacity would exceed projected demand in Alternatives A, B, and the Preferred Alternative (Figure 3-62g). The range among the alternatives is relatively small.

Figure 3-62g: Developed recreation capacity vs. projected use – Copper River Delta.



Dispersed recreation opportunities and capacities do not vary among alternatives, except Alternative B. Alternative B has the highest capacity because of one large area of Roaded ROS setting on the Copper River Delta. The Roaded ROS Class has a much higher capacity than other ROS classes. All the other alternatives have a much lower capacity because of the emphasis on Primitive and Semi-primitive recreation settings (Figure 3-63). In all alternatives, developed recreation capacity is in addition to the dispersed capacity.

Figure 3-63: Dispersed recreation capacity – Copper River Delta.



Recreation Conflicts and Situations

The major conflict or situation addressed in the alternatives for the Copper River Delta geographic area is the allocation of prescriptions and recreation settings in response to potential changes in access, significant national interest in wilderness and fish and wildlife management, and strong local interest in maintaining the status quo for recreation opportunities.

Many of the alternatives were specifically designed to allow for more intense recreation management within the Copper River Highway road corridor and along the road to Carbon Mountain. All the alternatives allocate Roaded ROS classes along these corridors. This approach allows for higher density of recreation use and development along these access routes while maintaining the Primitive and Semi-primitive recreation settings away from the roads. The rest of the Delta would be managed to provide Primitive and Semi-primitive recreation opportunities consistent with interests to manage fish and wildlife habitats and current activities.

Cumulative Effects

Recreation and Tourism cumulative effects will be addressed by the three major topics identified in the consequences section:

1. Recreation Settings;
2. Recreation infrastructure and capacity; and
3. Recreation conflicts and situations.

Recreation Settings

The range and distribution of recreation settings across the Forest in all alternatives is very consistent with adjacent lands to the Chugach National Forest. On the Kenai Peninsula, the settings of all alternatives are consistent and compatible with adjacent lands of the Kenai Fjords National Park, Kenai National Wildlife Refuge and Chugach State Park. Emphasis on concentrated development opportunities along existing road corridors and little or no recreation development away from main travel corridors complements adjacent lands and minimizes any effects in areas currently undeveloped. Alternatives proposing Wilderness designations adjacent to Wilderness in the Refuge or the National Park (Alternatives D, E and F) would be more consistent with management in those areas than non-wilderness prescriptions and management.

In Prince William Sound the generally undeveloped recreation settings in all alternatives compliment State Marine Parks within the Forest and State of Alaska and Bureau of Land Management lands to the north. Emphasis for any major development is on non-National Forest System lands. While there is no designated Wilderness adjacent to Prince William Sound, the adjacent land management is essentially wilderness in character, providing similar settings throughout the area.

On the Copper River Delta geographic area, the recreation settings in all alternatives are very compatible with adjacent lands to the north and east in Wrangell-St. Elias National Park and State of Alaska and Bureau of Land Management lands. Alternatives proposing Wilderness adjacent to Wrangell-St. Elias National Park offer a higher degree of consistency, but alternatives proposing Category 1 and 2 prescriptions are also very compatible.

Recreation Infrastructure and Capacity

All of the alternatives propose to increase the recreation infrastructure and capacity to some degree. In all alternatives, this increase is not intended to accommodate all the projected increases in recreation use throughout the region, but the Chugach National Forest's reasonable proportion of the anticipated increase. In all alternatives, increases in infrastructure and capacity are greatest on the Kenai Peninsula. This is consistent with the expected recreation settings and projected use. Additional infrastructure in Prince William Sound would be mostly dispersed consistent with the undeveloped and unroaded character in all alternatives and found on adjacent lands. On the Copper River Delta, any increase in infrastructure is along the Copper River Highway corridor with only

minimal increase away from the road corridor. Adjacent lands emphasize the same undeveloped character.

Recreation Conflicts and Situations

The major situation is the allocation of motorized and nonmotorized activities in summer and winter. This will be discussed in two parts: winter and summer.

Winter recreation motorized and nonmotorized access was the biggest and most controversial situation addressed in alternative development. The major conflict among recreation activities is between winter nonmotorized activities (cross country and backcountry skiing, snowshoeing, dog mushing) and motorized activities (snowmachining and heli-skiing). All of the alternatives, except the Preferred, allow winter snowmachine use across most of the Forest. The Preferred Alternative would be more restrictive in the Copper River Delta and Prince William Sound geographic areas. The Preferred Alternative has only slightly less winter snowmachine opportunity than is currently allowed. All of the Alternatives limit helicopter to some degree, with Alternatives D, E, and F, with major areas proposed for Wilderness designation, limiting helicopter opportunities the most. On the Kenai Peninsula, the cumulative effect of alternatives limiting motorized recreational access potentially displaces current users and moves them to other areas open on adjacent lands or within the Forest. Much of the half million acre Chugach State Park is closed to motorized access. Off road vehicles are allowed on two trials of the park: the Bird Creek Trail and, Sunday through Wednesday only, the Eklutna Lakeside Trail. Snowmobiles are allowed on 5 areas of the park when snow conditions are adequate. Kenai Fjords National Park has limited winter motorized access; the same is true for the Kenai National Wildlife Refuge to the west. Limiting access may concentrate more users within areas open on the Forest and areas adjacent to the Forest or to the north of Anchorage.

Limits on motorized access would provide areas for nonmotorized recreation activities, complementing a network of such areas through Southcentral Alaska. Alternatives C, D, E and the Preferred complement this the best.

In Prince William Sound, there is limited winter activity of any type. Alternatives recommending areas for Wilderness designation would limit possible helicopter skiing opportunities on the Forest. Areas adjacent to the Forest do currently allow for helicopter skiing access. Extremely remote and rugged terrain make motorized surface use very difficult except for a few areas around the edges of the Prince William Sound geographic area. Opportunities for nonmotorized activities are better, but like the motorized activities, access is very difficult for all users without boat or air support.

On the Copper River Delta, alternatives limiting motorized access would significantly reduce opportunities for recreation activity, as there are no reasonably close accessible lands. Lands to the north are National Park and lands to the east are very hard to get to. Helicopter skiing opportunities are available north of Cordova on State of Alaska lands. Alternatives providing for helicopter access, especially west of the Copper River, allow for an expansion of

winter heli-skiing opportunities. Alternatives recommending Wilderness designations on the Copper River Delta would significantly restrict helicopter access opportunities.

Summer motorized recreation opportunities are almost the opposite of winter. Currently almost all lands within the Chugach National Forest and all lands adjacent to the Forest are either closed to surface motorized uses (OHVs) either because of special designation, written closures or are unavailable for use due to the nature of the terrain. Alternatives that would allow for surface motorized uses within the Forest would increase recreation opportunities for off-road activities in Southcentral Alaska. Alternatives A, B and the No Action would increase surface motorized opportunities in Southcentral Alaska. Alternatives A, B, C, No Action, and the Preferred would increase or maintain status quo for summer helicopter access in Southcentral Alaska.

Summer helicopter activities, such as heli-hiking, are also restricted on many lands adjacent to the Chugach National Forest. Chugach State Park, Kenai Fjords National Park, Wrangell-St. Elias National Park, and Wilderness within the Kenai National Wildlife Refuge are all closed to helicopter access. Alternatives that allow for helicopter access would provide for summer heli-hiking opportunities.

Appendix F displays how motorized access (highway vehicles, high clearance vehicles, off road vehicles, motorcycles, and snowmachines) and nonmotorized access (horses, hikers, skiers, bicycles, and dog sleds) would be managed under each alternative.

Subsistence

Introduction

Subsistence hunting, fishing, trapping and gathering activities on the Chugach National Forest represent a major focus of life for many Southcentral Alaska residents. Some individuals participate in subsistence activities to supplement personal income and provide needed food. Others pursue subsistence activities to perpetuate cultural customs or traditions. Still others participate in activities for reasons unconnected with income or tradition. For all of these individuals, subsistence is a lifestyle reflecting deeply held attitudes, values and beliefs.

Legal and Administrative Framework

- **Alaska National Interest Lands Conservation Act (ANILCA) of 1980** - Title VIII of ANILCA provides for the continuation of customary and traditional uses of fish and wildlife resources on public lands by residents of rural Alaska. This must be consistent with sound management principles and the conservation of healthy fish and wildlife populations. Section 803 defines subsistence as, "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal or family consumption as food, shelter, fuel, clothing, tools, or transportation: for the making and selling of handicraft articles out of non-edible by products of fish and wildlife resources taken for personal for family consumption; barter, or sharing for personal or family consumption; and for customary trade."

  ANILCA provides for continuation of the opportunity for subsistence by rural residents of Alaska, including Natives and non-Natives, on the public lands." It also states, in part, that "customary and traditional" subsistence uses shall be the priority consumptive uses of all such resources on public lands. This must be consistent with sound management principles and the conservation of healthy fish and wildlife populations. Section 810 requires the Forest Service to determine whether actions will impact subsistence uses.

Key Indicators

- Habitat capability and management intensity that would affect species important to subsistence
- Acres of habitat where traditional access is not limited
- Miles of new road construction
- Number of backcountry sites

Resource Protection Measures

All areas on the Chugach National Forest are available for harvest of wild resources for subsistence purposes regardless of the management prescription, except for small areas that might be restricted due to safety concerns such as active mines or developed recreation sites. Title VIII of ANILCA clearly states that Alaska rural residents have priority for uses of these resources. Resource protection measures are in place to protect the key subsistence based species. The implementation of Forestwide standards and guidelines, Best Management Practices (BMPs), and minerals leasing stipulations, all contribute to the resource protection measures for fish and wildlife. These protection measures apply to all alternatives. Once an alternative has been selected and implementation starts, monitoring will be initiated to determine if the appropriate protection measures have been implemented and if the measures are adequate. Changes in either the method of implementation or the protection measure will occur if either does not adequately protect subsistence resources or productivity.

Section 810 of ANILCA requires a federal agency, having jurisdiction over lands in Alaska, to evaluate the potential effects of the proposed land use activities on subsistence uses and needs, followed by a specific determination whether there will be a significant possibility of a significant restriction of subsistence uses. A significant possibility of a significant restriction is defined as when a proposed action has an expected outcome where a substantial reduction in the opportunity to continue subsistence uses of renewable resources occurs. Based on this analysis it is determined that in combination with past, present, and reasonably foreseeable future actions, none of the alternatives, if implemented through the project implementation stage, may result in a significant possibility of a significant restriction of subsistence uses of a wild resource due to the potential effects on abundance and distribution of fish and wildlife, limits to access, or increases of competition. Competition may increase as long as Alaska rural population grows and additional access is created for non-rural users to access the subsistence resources. These factors may cause a need for federal subsistence regulatory changes to protect subsistence uses.

Affected Environment

Forestwide

Who Subsistence Users Are

The communities in or adjacent to the Chugach National Forest that are currently determined to be rural are the communities of Hope, Cooper Landing, Whittier, Chenega Bay, Tatitlek, and Cordova. The first three communities are located in the northern end of the Kenai Peninsula. This region of the Kenai Peninsula is habitat for moose, black bear, brown bear, mountain goat, and Dall sheep. Caribou were reintroduced to the area by the Alaska Department of Fish and Game in 1965. Furbearers, such as wolves, coyote, lynx, mink, river otters, wolverine, hares, and beaver are common. A variety of anadromous fishes are present, including chinook, chum, coho, pink and sockeye salmon, which spawn

in abundance around these local communities. Birds such as sandhill cranes, ptarmigan, grouse, ducks, and eagles are also found in the area.

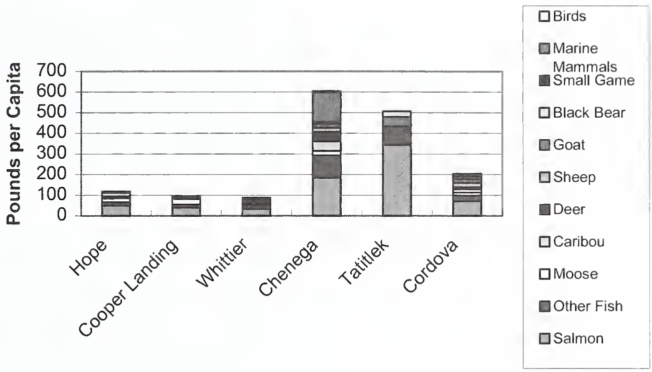
The communities of Whittier, Chenega, Tatitlek, and Cordova lie in the ice-free areas of Prince William Sound. In addition to the upland and freshwater habitat resources found on the Kenai Peninsula, deer are also found along the coastlines and the islands of Prince William Sound. For residents of Prince William Sound caribou and Dall sheep are not available on the Copper River Delta or Prince William Sound. The area also contains saltwater wetlands and tidal flats, in addition to the extensive marine waters. These saltwater resources support a variety of saltwater resources, such as bottom fish, crab, scrimp, clams and other varieties of marine invertebrates.

Particularly in Prince William Sound, where the economy is highly seasonal and resource based, subsistence harvest of fish and wildlife resources takes on much importance. The use of these resources may play a major role in supplementing cash incomes during periods when opportunity to participate in the wage economy is either marginal or nonexistent. Due to the high prices of commercial products, especially in remote communities, the economic role of locally available fish and wildlife takes on added importance.

The subsistence resource inventories are available for all six rural communities that use the Chugach for subsistence activities. Collectively, these communities hunted, fished and collected plants and marine invertebrates throughout virtually the entire Forest. Subsistence resource information is available for Chenega Bay (1984, 85, 89, 90, 91, 92, 93), Tatitlek (1993), Cordova (1985, 1988, 1991, 1993), Whittier (1990), Hope (1990), and Cooper Landing (1990). Of the six communities considered, the predominantly Native villages of Chenega Bay and Tatitlek rely upon the Forest the most, averaging 605 and 507 pounds per person of wild resources for home use in the early 1990s. This is typical of isolated rural, subsistence-dependent coastal or interior communities. In 1993, Cordova residents harvested an average of 204 pounds per person, similar to southeast Alaska rural communities, which average about 210 pounds per capita. Hope, Cooper Landing and Whittier harvested 111, 92 and 80 pounds per person respectively. By comparison non-rural areas such as Anchorage, Matanuska-Susitna Borough, and the Kenai Borough average 48 pounds per person. The average number of resources used per household per year ranged from 19 in Tatitlek and Chenega Bay to 8 in Whittier and Cooper Landing.

Figure 3-64 summarizes the use patterns and amounts for the six rural communities known to use the Chugach National Forest for subsistence purposes. Included are wild resources that are found on the Chugach. The six communities are variable in the variety and amount of harvests, though all show a harvest predominance of fish, particularly salmon.

Figure 3-64: Subsistence use by six rural communities in or adjacent to the Chugach National Forest.



Source: Seitz and Fall 1992, Fall and Uttermohle 1995.

Subsistence Use Pattern

The following is a general area description for rural community subsistence use by key subsistence resource. A more detailed description can be found depicted within the Chugach National Forest subsistence use area maps.

Salmon
Whittier residents reported harvesting salmon along Passage Canal and around Knight, Naked and Montague Islands. Tatitlek residents indicated using an area bounded by Port Fidalgo to the east, Jack Bay to the north, and Glacier Island to the west. Chenega Bay people (in the mid-1980s) got salmon at Evans, Green, Montague, Chenega, and Latouche islands, Knight Island Passage, Whale Bay, Jackpot Bay, Eshamy and the Tatitlek/Bligh Island area. Cordova residents obtained salmon from the Copper River Flats, Eyak and Alaganik rivers, Orca Inlet, Simpson Bay, and McKinley Lake. Other non-specified areas likely were also used. Hope and Cooper Landing residents obtained salmon primarily from the Kanai River, Russian River, Sixmile Creek, and Resurrection Creek.

Deer
Deer harvests occurred mainly on the islands throughout Prince William Sound: Chenega, Knight, Hawkins, Hinchinbrook, Montague, Esther, Evans, Latouche, Green and Elrington Islands. Cooper Landing residents reported deer hunting on Knight Island and Montague Island.

Moose
Hope and Cooper Landing residents reported hunting moose in the Bear Valley and Placer River drainage, as well as most other drainages along the major

stream valleys on the Northeastern Kenai Peninsula. Whittier residents said they hunted moose in Kings Bay and Port Nellie Juan. Cordovans hunted moose around the Martin River, the western Copper River Delta, and the Bering River.

Mountain Goats

Whittier residents reported hunting mountain goats in non-specified areas of northern Prince William Sound, and Cordova residents mentioned hunting at St. Matthews Bay, McKinley Peak, Port Fidalgo, and Port Bainbridge. Cooper Landing and Hope residents hunt mountain goats along the eastern flank of the Kenai Peninsula. Tatitlek residents hunt goats primarily in Ports Gravina and Fidalgo, Valdez Arm, and Long Bay. Chenega Bay residents harvest goats primarily in Port Bainbridge.

Black Bears

Black bears were hunted by residents of Whittier in Port Wells and College Fiord, while Tatitlek hunters used the northern half of the Sound including the northern portion of Esther Island. Chenega Bay residents hunted black bear on Evans, Knight and (to a lesser extent) Bainbridge Islands. Cordova hunters used the Copper River road system, and Port Gravina. Hope and Cooper Landing people hunt within most of the valley areas on the Kenai Peninsula.

Birds

Birds were hunted by Whittier residents at Green, Culross, and Perry Islands and the northwest side of Montague Island. Chenega Bay hunters went to Latouche, Squire, Elrington and Knight islands as well as Sawmill Bay and around Evans Island to hunt birds. Cordova residents hunted waterfowl at Alaganik Slough, Boswell Bay, the Copper River Delta and Flats, Controller Bay, the Eyak River, Hawkins, Wingham and Hinchinbrook Islands, and Simpson Bay. Hope and Cooper Landing residents have harvested birds from most areas on the Chugach portion of the Kenai Peninsula.

Marine Mammals

Tatitlek residents described their marine mammal hunting area as spanning the northern half of the sound as far west as Port Wells and around Esther and Perry Islands. Chenega Bay residents indicated a large part of the western Sound and, to a lesser extent, also in the eastern Sound, with their highest use area being within a 6- to 12-mile radius from the village. Other locations that Chenega Bay residents mentioned were Knight Island Passage, Chenega Island and the outer shoreline of Main Bay/Eshamy Bay area and points north, west and east.

Marine Invertebrates

Most of Prince William Sound was used for harvesting marine invertebrates. Whittier residents used the eastern portion of Prince William Sound. Chenega Bay residents obtained marine invertebrates in Port Wells and Culross Passage as well as these islands: Chenega, Green, Hawkins, Eleanor, Knight, Squire, Montague, Latouche, Elrington, Bainbridge and Evans. Cordovans harvested crab from Orca Inlet and Orca Bay, Simpson Bay, Gravina Bay, and the Copper River Flats, shrimp from Port Wells, Simpson, Eshamy and Unakwik Bays, and near Naked Island, and they got clams from the Copper River Delta and

Controller Bay, the Copper River Flats, Montague Island, Canoe Pass and Simpson Bay.

Environmental Consequences

Effects of alternatives on subsistence resources and use on the six rural communities in and adjacent to the Forest are presented here. The Forestwide evaluation is presented based on general considerations in the three categories of effects previously identified: abundance and distribution of fish wildlife, and other wild resources, maintenance of access to these resources, and increases in competition by non-rural users competition. The analysis relies on the Forestwide effects analyses from the related resource sections (primarily Aquatic Ecosystems and Essential Fish Habitat and Forested Vegetation) where abundance and distribution are an issue.

Section 810 of ANILCA requires the Forest Service, in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of national forest lands in Alaska, to evaluate the potential effects on subsistence uses and needs, followed by specific notice and determination procedures should there be a significant possibility of a significant restriction of subsistence uses. The Alaska Land Use Council's definition of "significantly restrict subsistence use" is one guideline used in the evaluation: "A proposed action shall be considered to significantly restrict subsistence uses, if after any modification warranted by consideration of alternatives, conditions, or stipulations, it can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources." Considerations of abundance and distribution, access, and competition (by non-rural residents) are mentioned. The U.S. District Court Decision of Record in *Kunaknana v. Watt* provided additional clarification. In part it states: "restrictions for subsistence uses would be significant if there were large reductions in abundance or major redistribution of these resources, substantial interference with harvestable access to active subsistence-use sites or major increases in non-rural resident hunting."

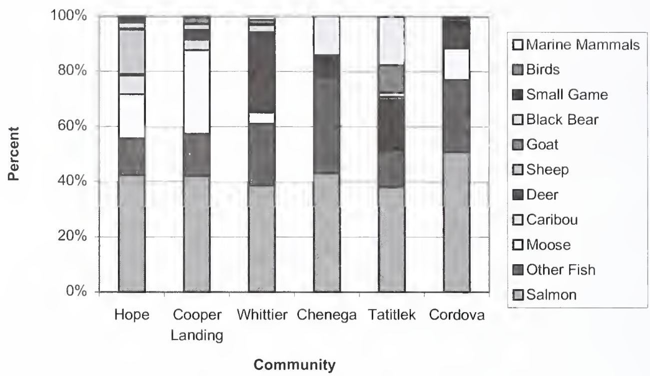
Direct and Indirect Effects

Abundance and Distribution

Figure 3-65 shows the percentage of wildlife resources for each of the six rural communities. Fish are the primary subsistence resource. Use ranges from 56 percent in Tatitlek to 79 percent (by weight) at Chenega Bay. Salmon account for the bulk of the fish resource, accounting for 40 to 50 percent of the total resources used. Of the large land mammals used, deer and moose are primary species. Deer harvest which accounts for 10 percent of all use by the six communities, ranges from 1 percent in Hope to 29 percent in Whittier. Moose

account for 7 percent of the total use, ranging from no reported use in Chenega Bay and Tatitlek to 30 percent in Cooper Landing.

Figure 3-65: Percentage use of wild resources by community.



Source: Seitz and Fall 1992, Fall and Uttermohle 1995.

Effects of Alternatives on the subsistence opportunities were evaluated using a two-step coarse filter/fine filter approach. The methodology uses a matrix that defines all possible combinations of habitat conditions and management activities that affect the subsistence use. The coarse filter evaluation compares the overall habitat value of areas used for subsistence to the management intensity prescribed for each of the planning units. Habitat was assigned a high, medium, or low ranking based on habitat suitability effectiveness modeling, discussed within the Wildlife section. Management intensity was defined as low for Category 1 and 2 prescriptions, medium for Category 3 and 4 prescriptions, and high for Category 5 prescriptions. Table 3-58 summarizes the outcome. Comparisons are made in terms of acreage and percentages.

Table 3-58: Coarse filter comparison of habitat effectiveness to management intensity.

		Area Used For Subsistence Management Intensity (Acres)				Percent Total Acres			
		Hi	Med	Lo	SUBTOTAL	Hi	Med	Lo	SUBTOTAL
No Action									
Overall	Hi	2,410	561,610	342,920	906,940	0.09	22.01	13.44	35.55
Habitat	Med	6,650	641,720	673,260	1,321,630	0.26	25.15	26.39	51.80
Effectiveness	Lo	3,110	175,910	143,780	322,800	0.12	6.89	5.64	12.65
	Total	**12,170**	**1,379,240**	**1,159,960**	**2,551,370**	**0.48**	**54.06**	**45.46**	**100.00**
Preferred Alternative									
Overall	Hi	2,410	108,260	796,270	906,940	0.09	4.24	31.21	35.55
Habitat	Med	6,650	90,140	1,224,840	1,321,630	0.26	3.53	48.01	51.80
Effectiveness	Lo	3,110	27,160	292,530	322,800	0.12	1.06	11.47	12.65
	Total	**12,170**	**225,560**	**2,313,640**	**2,551,370**	**0.48**	**8.84**	**90.68**	**100.00**
Alternative A									
Overall	Hi	2,410	618,790	285,740	906,940	0.09	24.25	11.20	35.55
Habitat	Med	6,650	954,700	360,280	1,321,630	0.26	37.42	14.12	51.80
Effectiveness	Lo	3,110	230,880	88,810	322,800	0.12	9.05	3.48	12.65
	Total	**12,170**	**1,804,370**	**734,830**	**2,551,370**	**0.48**	**70.72**	**28.80**	**100.00**
Alternative B									
Overall	Hi	2,410	395,230	509,300	906,940	0.09	15.49	19.96	35.55
Habitat	Med	6,650	556,220	758,760	1,321,630	0.26	21.80	29.74	51.80
Effectiveness	Lo	3,110	137,580	182,110	322,800	0.12	5.39	7.14	12.65
	Total	**12,170**	**1,089,030**	**1,450,170**	**2,551,370**	**0.48**	**42.68**	**56.84**	**100.00**
Alternative C									
Overall	Hi	2,410	102,580	801,950	906,940	0.09	4.02	31.43	35.55
Habitat	Med	6,650	114,820	1,200,160	1,321,630	0.26	4.50	47.04	51.80
Effectiveness	Lo	3,110	33,240	286,450	322,800	0.12	1.30	11.23	12.65
	Total	**12,170**	**250,640**	**2,288,560**	**2,551,370**	**0.48**	**9.82**	**89.70**	**100.00**
Alternative D									
Overall	Hi	2,410	38,320	866,210	906,940	0.09	1.50	33.95	35.55
Habitat	Med	6,650	41,040	1,273,940	1,321,630	0.26	1.61	49.93	51.80
Effectiveness	Lo	3,110	13,710	305,980	322,800	0.12	0.54	11.99	12.65
	Total	**12,170**	**93,070**	**2,446,130**	**2,551,370**	**0.48**	**3.65**	**95.88**	**100.00**
Alternative E									
Overall	Hi	2,410	5,160	899,370	906,940	0.09	0.20	35.25	35.55
Habitat	Med	6,650	7,800	1,307,180	1,321,630	0.26	0.31	51.23	51.80
Effectiveness	Lo	3,110	1,750	317,940	322,800	0.12	0.07	12.46	12.65
	Total	**12,170**	**14,710**	**2,524,490**	**2,551,370**	**0.48**	**0.58**	**98.95**	**100.00**
Alternative F									
Overall	Hi	2,410	6,140	898,390	906,940	0.09	0.24	35.21	35.55
Habitat	Med	6,650	12,410	1,302,570	1,321,630	0.26	0.49	51.05	51.80
Effectiveness	Lo	3,110	4,910	314,780	322,800	0.12	0.19	12.34	12.65
	Total	**12,170**	**23,460**	**2,515,740**	**2,551,370**	**0.48**	**0.92**	**98.60**	**100.00**

The outcome of the coarse filter analysis is discussed below. Of the 2.5 million acres used for subsistence, 900,000 acres (35 percent) are in the high habitat effectiveness category, 1,300,000 acres (52 percent) are moderate, and 320,000 acres (13 percent) are low value. The alternatives fall into three general ranges. Alternatives C, Preferred, D, E, and F have 90, 91, 96, 99, and 99 percent of subsistence use areas in low management intensity prescriptions, respectively.

The No Action and Alternative C have about 45 and 57 percent, respectively. Alternative A has 29 percent in low management intensity prescriptions.

Alternatives C, Preferred, D, E, and F have 90 percent or more of the suitable subsistence use area in low management intensity planning units. These alternatives are not analyzed further because they are determined to have no significant possibility of having a significant restriction on subsistence use.

A fine filter analysis is used to determine the potential effect of management activities on subsistence uses within areas where moderate management intensities are prescribed. Abundance and distribution of deer, moose, and fish and personal use wood products such as firewood are the resources used by rural residents that could respond to the varying alternatives. The primary subsistence resource experiencing potential downward trend in population from management activities is Sitka black-tailed deer. These effects are tied to harvest of old-growth closed canopy forest in Alternatives A, the No Action Alternative, and Alternative B. The areas for potential timber harvest in the Outside Montague watershed association lie within the hunting areas for the communities of Cordova and Cooper Landing (Fall and Uttermohle 1995, Seitz and Fall 1992). Deer are assumed to be an “indicator” for potential subsistence resource consequences concerning the abundance and distribution of the wildlife, due to the association of Sitka black-tailed deer with old-growth forest habitat.

Analysis of the deer hunting patterns from ADF&G Profile Database studies indicate that the Outside Montague and the McKinley Lake Watershed Associations are areas where deer harvest activities and potential timber harvest intersect. Cordova and Cooper Landing residents are the rural residents who reported hunting within the areas. Table 3-59 depicts high value deer habitat within Prince William Sound And Montague Island. The No Action, Alternative A, and Alternative B proposed timber harvest acreage and are included for analysis. All timber harvest acreage is assumed to be high value habitat deer habitat.

Table 3-59: Percentage of high value deer habitat harvested by alternative.

Effective Deer Habitat	High Value Acres	% of High PWS Value Deer Habitat	% of Montague Is High Value Deer Habitat
Montague Outside	13,760	3	37
No Action 1st decade harvest	2,090	0.4	6
Alt A 1st decade harvest	3,250	0.7	8
Alt B 1st decade harvest	1,940	0.4	5
Montague Inside-Green Island	23,430	5	63
Total Montague	**37,190**	**8**	**not applicable**
Total Prince William Sound	**456,420**	**100**	**not applicable**

Source: Chugach National Forest GIS corporate database.

Montague Island represents about 8 percent of the total high value deer habitat in Prince William Sound, while the Outside Montague Island watershed association is 3 percent of the total. Alternatives No Action, Alternative B, and

Alternative A harvests are 0.7, 0.7, and 0.4 percent of the total high value deer habitat with Prince William Sound, respectively. The percentage of high value deer habitat harvested on Montague Island is 6, 8, and 5 percent, respectively, for the No Action, Alternative A, and Alternative B. Timber harvest on these very small percentages of the total high value deer habitat is assumed to be not significant.

Moose are an important subsistence species on the Kenai Peninsula and Copper River Delta. Moose comprise the largest percentage of land mammals harvested by the communities of Hope, Cooper Landing, and Cordova. Moose numbers on the Kenai Peninsula have decreased from 15,000 in 1970 to 8,000 in 2000 (Lottsfeldt-Frost 2000). Moose habitat indices indicate that there would be a slight decrease in moose habitat capability as vegetation succession moves toward closed needle leaf forest stands on the Kenai Peninsula. There would be 30 percent less broadleaf forest acreage, resulting in a slight downward decrease in moose carrying capacity. Alternatives A, B, C, No Action, and the Preferred propose burning 2,248 acres and mechanically treating 384 acres per year to promote early successional stage vegetation important for moose winter habitat. Alternative D proposes burning 1,558 acres and mechanically treating 236 acres per year. Alternatives E and F propose 910 and 920 acres of prescribed burns, and 137 and 140 acres of mechanical treatments per year, respectively.

Moose are also found on the Cooper River Delta. Successional pathways on the Copper River Delta indicate that the overall vegetation composition on the Copper River Delta would remain in balance and moose carrying capacity would remain steady.

All other wildlife populations used by subsistence hunters are estimated to have a steady or slightly increasing trend.

Effects to fish habitat may also result from land management activities, but the magnitude of the effects cannot be calculated, and are determined to be minimal with application of Aquatic Ecosystem standards and guidelines and Best Management Practices. Based on the amount of stream miles that fall within low management intensity Category 1 and 2 prescriptions resulted in the following order of increasing risk: Alternatives F, E, D, Preferred, C, B, No Action, and A.

Fish habitat and riparian habitat restoration activities are permitted in varying degree by all alternatives. Fish enhancement projects benefit subsistence users through increased numbers of fish within subsistence use areas. Alternatives response to the subsistence situation can be also ranked on number miles and acres of anadromous fish habitat improvement. Some projects are specifically directed toward subsistence users. All alternatives, except for F, propose 1,722 acres of anadromous fish habitat enhancement and 82 miles of stream improvement. Alternative F proposes 414 acres and 82 miles of improvement.

Subsistence Access

Access to subsistence hunting and fishing areas on the Chugach would not be impacted by any alternatives. Historical access has been primarily by foot, boat, and floatplane, and is available in all the alternatives for present and the

foreseeable future activities. The Preferred Alternative would have one area, Power Creek (11,750 acres), northeast of Cordova, where motorized access for subsistence purposes would not be permitted. Alternative C, E, and F propose two planning areas with a total of 22,790 acres where motorized access for subsistence purposes would not be permitted. Alternative D proposes expanding these areas to 91,580 acres. The alternatives are determined not to have a significant restriction in subsistence access. The rationale is these two areas have low capability for summer motorized use due to environmental factors such as numerous wetlands alternating with heavily forested floodplains and mountain slopes. The areas are also unsuitable for winter snowmobile use due to steep topography and avalanche hazards.

As a result of new road construction, new use patterns are likely to develop around some communities. Some rural residents view this as a positive development. Some rural residents may view it as a negative development. All alternatives would have some new road construction. Table 3-60 shows the new road construction for the first decade.

Table 3-60: Miles of road, end of first decade.

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Miles of Road Construction	67	33	114	100	29	22	16	13
Total Miles Available	170	129	217	232	139	119	113	110

Competition

Competition for subsistence resources is a result of factors such as fish and game regulations, mobility, the natural distribution of fish and game species across the Chugach, decreases in resource populations as a result of habitat reductions, decreases in resource populations as a result of over-harvest, and access provided to rural communities in the form of roads, ferries, and commercial air carriers. The majority of the population (Anchorage) surrounding the Chugach is non-rural. Competition for the more abundant wildlife and fisheries resources near rural communities results from the combination of these factors. For analyzing competition, the following assumptions are made:

1. New road construction adjacent to communities with ferry access will result in increased competition from outside communities.
2. New road construction adjacent to existing road systems where interties between communities exist will result in increased competition from surrounding communities associated with the inter-connected roads.

3. Large group development sites will increase competition for resources used by rural residents. Development may also displace users from traditionally used sites.

Alternatives A, B and the No Action are the only alternative that have a significant gain in road mileage during the first decade. Alternative A has 41 miles of interconnected road. Alternative B has 21 miles of interconnected road. The No Action Alternative has 13 miles. If this small number of additional miles caused excess competition, restriction by regulating road use to meet subsistence needs could be effected.

Developed recreation sites where groups of people concentrate may cause displacement from traditionally used hunting and fishing subsistence areas. Community leaders from the rural villages of Tatitlek and Chenega Bay have expressed concern about backcountry group site potential disruption of subsistence activities from areas they have traditionally used in Prince William Sound. McClure Bay, Coghill Point, Long Bay, Miners Bay, and Port Fidalgo are the areas of their greatest concern. The alternatives differ in numbers of proposed backcountry group sites within Prince William Sound and the Copper River. The following table (Table 3-61) reflects the number of the two Backcountry Group group sites per alternative.

Table 3-61: Backcountry Groups facilities by alternative.

Facility Type	Alternative							
	No Action	Preferred	A[1]	B[1]	C	D	E	F
Developed	N/A	2	N/A	N/A	20	0	3	0
Limited or No Facilities	N/A	0	N/A	N/A	22	0	0	0
Total	**N/A**	**2**	**N/A**	**N/A**	**42**	**0**	**3**	**0**

[1] N/A = Not Available. These alternatives contain prescriptions that allow lodges within all suitable areas.

The impact of the proposed sites would vary depending on the season of use of the facilities and the number of trips made to the sites. Alternatives with the most Backcountry Group sites have potential to impact subsistence activities. Impacts to subsistence activities could be mitigated by developing facility season of use around the subsistence harvest seasonal rounds within the areas. Alternatives A, B, and No Action have prescriptions which emphasize lodges and other commercial enterprises. These alternatives would likely increase competition above the level resulting from the implementation of the other alternatives.

Given the small amount of development in any of the alternatives, all alternatives do not have a significant possibility of a significant restriction of subsistence use by increasing competition for some subsistence resources.

Cumulative Effects

Effects Resulting from Past Actions

Exxon Valdez Oil Spill

The *Exxon Valdez* oil spill impacted subsistence uses and patterns over the last 10 years. Subsistence uses dropped after the oil spill, and still have not returned

to normal. Concern over hydrocarbon contamination, particularly on marine resources has caused concern. This may create displaced uses on terrestrial resources, creating a greater need for land mammals and fish. This could increase hunting and fishing demands on National Forest System lands.

Native corporation harvest operations over the last 15 years have harvested large blocks of timber adjacent to National Forest System lands. Harvest has been primarily on Montague Island, the Knowles Head area, and the area between Scott River and Sheridan River. The harvest on Native corporation lands is anticipated to continue, but at a very low level over the next decade. The resulting lower deer habitat capabilities on these private lands, particularly in Prince William Sound, could increase hunting demands in adjacent National Forest System areas, increasing competition and potentially leading to reduced hunter success, and reduced or eliminated sport seasons.

Effects Resulting from Present Actions
Whittier Road
The Whittier Road could have cumulative effects on subsistence activities. The projected increase in recreational sport hunting and fishing days is expected to greatly increase. The Whittier Road Environmental Impact Statement predicted sport fishing increases upwards to 760 percent over present conditions near Whittier. The increases in sport fishing around Chenega were predicted to be much less, around 33 percent. These increases were determined to not create a significant restriction to subsistence activities in this same EIS, due to the growth in production of hatchery fish (USDOT 1995).

Harvest of deer within the Prince William Sound is also predicted to increase, though much less rapidly. These increases ranged from 10 to 100 percent on Perry Island. The closer to Whittier the larger the increase in predicted deer harvest numbers. Because of the projected increase in demand, the number of deer may be insufficient to meet demands in the future. The result is an increase in predicted harvest of deer harvest above the deer harvest objectives established for Prince William Sound, and possible restriction on deer harvest. As Forest Service management activities will not have an impact on the carrying capacity of these areas, it may be possible to minimize this restriction by regulating non-subsistence uses in areas most heavily used by rural residents for deer harvests. The implementation of Alternatives A, B and the No Action may reduce deer numbers slightly on Montague Island, however the overall effect would not result in a substantial cumulative effect on wildlife.

Findings
Based on the above analysis and considering all relevant information in this analysis, the impact of the proposed action combined with the reasonably foreseeable future activities, and activities planned on adjacent lands, would not significantly restrict subsistence use of wild resources within the Chugach National Forest.

Research Natural Areas

Introduction

Research Natural Areas (RNAs) are selected from relatively undisturbed areas to represent the spectrum of natural ecosystems and special or unique characteristics of scientific importance. RNAs are managed for the purposes of maintaining biological diversity, conducting non-manipulative research and monitoring, and fostering education. Because they are managed in a natural state, RNAs serve as controls for evaluating long-term effects and ecological change on managed areas. By encompassing a wide range of habitats, RNAs provide habitat for little known or unknown forms of biological diversity, including insects, fungi, and soil organisms. In short, RNAs function as biological repositories, safeguarding habitats, species, and natural processes for the future.

Legal and Administrative Framework

- Planning regulations **(36 CFR 219.25)** state that forest planning shall provide for the establishment of Research Natural Areas. Planning shall make provision for the identification of examples of important forest, shrubland, grassland, alpine, aquatic, and geologic types that have special or unique characteristics of scientific interest and importance and that are needed to complete the national network of RNAs.
- On July 19, 1993, the Chief of the Forest Service issued a national strategy for recognizing the expanding role of RNAs in ecosystem management. An important part of this strategy was to delegate authority to the Regional Forester to designate RNAs.
- RNA selection procedures focus on fulfilling RNA objectives, which can be found in section 4063.03 of the **Forest Service Manual**. The Alaska Region developed a supplement to the Forest Service Manual (supplement no. 4000-93-1) that identifies the primary objectives for use of RNAs within the Region. Additionally, section 4063.2 or the Alaska Region supplement specifies processes to be used to select areas on National Forest System lands within Alaska.

Key Indicators

The following key indicator was identified for summarizing success of the RNA network in meeting representativeness objectives:

- Number and acres of proposed and existing RNAs

Resource Protection Measures

RNA management focuses on allowing natural conditions to prevail, usually by eliminating or limiting human intervention (USDA Forest Service 1992b). Prescribed management actions may be used to restore processes. For example, RNAs prone to natural fires, but where humans have prevented fire occurrence, may need to be managed with prescribed fire. Activities that are almost never appropriate in RNAs include (S. Greene personal communication):

- herbicide, pesticide or nutrient application;
- removal of groups of trees;
- introduction of off-site species; and,
- impoundments or diversions of streams.

Affected Environment

The 1984 Forest Plan proposed nine areas as RNAs (totaling 71,100 acres). Of these, only the 2,500-acre Green Island RNA has been designated. While the nine areas proposed include important features of diversity, a disproportionate number (5 of 9) represent glacial features. Moreover, only one area focuses on wetlands. High biomass forests, aquatic features, and alpine tundra appear inadequately represented as well (Juday 1981).

Additional deficiencies were also found by an analysis (Juday 1981) of how well the nine areas meet ecological feature types. The set of a range of proposed RNAs represents 36 of 69 feature types (52 percent). Deficiencies were also found in how well the proposed RNA network and recommended Wilderness from the 1984 Forest Plan encompasses the range of bioclimatic types (DeVelice and Hagenstein 1995). The proposed RNAs and recommended Wilderness adequately represent only 26 and 34 percent of the bioclimatic classes, respectively.

The Forestwide representativeness analysis was conducted to resolve these deficiencies (DeVelice 1999). Based on this analysis, a network of eight proposed RNAs (including Green Island) were selected for alternative analysis for the Revised Forest Plan. Figure 3-66, on the next page, displays the location of the seven proposed RNAs plus Green Island RNA.

Figure 3-67 (from DeVelice 1999) displays the bioenvironmental class representation within the proposed network of eight RNAs sorted by the Forestwide total area of each bioenvironmental class. As can be seen, the bioenvironmental classes with the least total area are most poorly represented in the proposed network (0 out of 14 classes). In contrast, the bioenvironmental classes with the greatest total area are 75 percent represented (3 out of 4 classes) within the proposed network.

Figure 3-66: Location of the eight eligible RNAs, including the existing Green Island RNA within the Chugach National Forest.

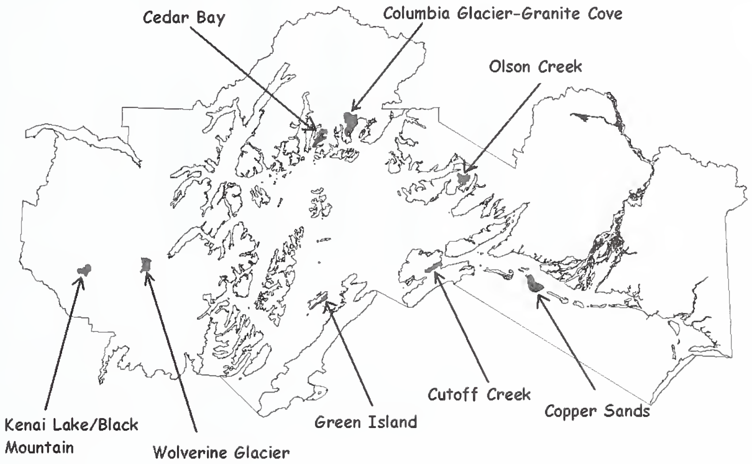
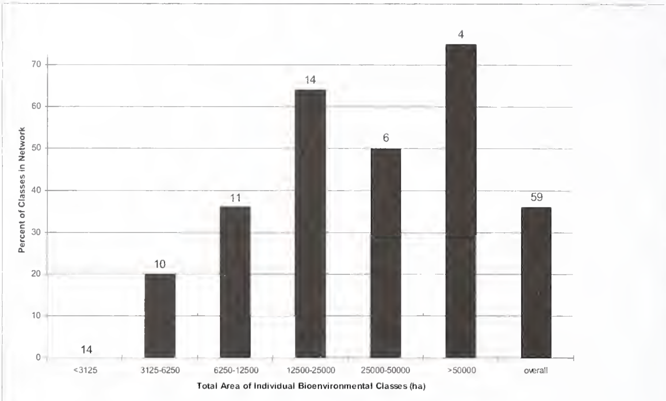


Figure 3-67: Bioenvironmental class representation within the eligible network of eight RNAs sorted by total area of each bioenvironmental class.[1]



[1] The number above each bar represents the number of bioenvironmental classes within that total area class (59 bioenvironmental classes overall).

Environmental Consequences

General Effects

The Preferred Alternative recommends four new RNAs: Copper Sands, Kenai Lake/Black Mountain, Wolverine Glacier, and Olsen Creek. Including the 2,500-acre designated Green Mountain RNA, they total 21,500 acres. Characteristics of each of the four recommended RNAs include the following: 1) the Copper Sands area is a barrier island (including breakwater sandbars). It is a site of active vegetation succession on sand dunes; 2) the Kenai Lake/Black Mountain area contains representations of many of the vegetation type and biophysical combinations present within the mountainous interior portion of the Kenai Peninsula; 3) the Wolverine Glacier area represents a mid-elevation glacier with a limited gathering area. A diversity of forest and tundra plant communities is also present; and, 4) the Olsen Creek area has been the site of extensive non-manipulative fisheries (anadromous species) research and also contains a wide diversity of vegetation types and landforms.

The No Action Alternative includes the nine areas from the 1984 Forest Plan for 71,100 acres. Alternative A includes only the designated Green Island RNA. In addition to the 2,500-acre Green Island RNA, Alternative B proposes three new RNAs totaling 20,900 acres, Alternative C proposes four new RNAs totaling 32,400 acres, Alternative E proposes six new RNAs totaling 41,700 acres, and

Alternative D and F propose seven new areas totaling 46,600 acres. Table 3-62 summarizes acreage of proposed RNAs by alternative.

Table 3-62: Acreage of designated (Green Island) and eligible RNAs by alternative (acres rounded to hundreds).

Area	Ecological Subsection	Alternative							
		NA	Preferred	A	B	C	D	E	F
Green Island	PWS[1] Islands	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Columbia Glacier-Granite Cove	Chugach Icefields	12,300		.	.	.	12,300	12,300	12,300
Copper Sands	Copper River Delta	1,500	1,500	.	.	1,500	1,500	1,500	1,500
Kenai Lake/Black Mountain	Kenai Fjordlands	3,800	3,800	.	6,000	6,000	6,000	6,000	6,000
Wolverine Glacier	Chugach Icefields	7,000	7,000	.	.	.	7,000	7,000	7,000
Cedar Bay	PWS[1] Mainland	.		.	5,700	5,700	5,700	5,700	5,700
Cutoff Creek	PWS[1] Islands	.		.	.	.	4,900	.	4,900
Olsen Creek	PWS[1] Mainland	.	6,700	.	6,700	6,700	6,700	6,700	6,700
Blackstone Glacier	Chugach Icefields	4,100		.	.	.	.	.	.
Harvard Glacier	Chugach Icefields	22,000		.	.	.	.	.	.
Pete Dahl Slough	Copper River Delta	9,300		.	.	.	.	.	.
Schwan Glacier Terminus	Chugach Icefields	8,600		.	.	.	.	.	.
Total Acres		**71,100**	**21,500**	**2,500**	**20,900**	**22,400**	**46,600**	**41,700**	**46,600**

[1] PWS refers to Prince William Sound.

RNAs are managed to maintain natural (relatively pristine/presettlement) conditions by allowing ecological processes to prevail with minimal human intervention. However, under some circumstances, deliberate manipulation may be utilized to maintain the ecosystem or unique features for which the RNA was established or to re-establish natural ecological processes. Vegetation, habitat, soil productivity, water quality, and ecological processes will be in a natural condition or in as close a natural condition as practicable. Heritage resources are protected by RNA designation since ground-disturbing activities are limited.

A variety of uses are allowed in RNAs as long as the activity or use does not become a threat to the values for which the RNA was proposed.

Direct and Indirect Effects

No activities are allowed within RNAs that could compromise the values for which RNAs are established. The following section focuses on displaying the effects of potential RNA allocations on other activities.

Effects of RNA classification on Heritage Resource Management

If archaeological or other cultural resources exist in any of the proposed RNAs these resources would be given additional protection through RNA designation since ground-disturbing activities are limited.

Effects of RNA classification on Biodiversity Management

RNA management focuses on allowing natural conditions to prevail, usually by eliminating or limiting human intervention. Therefore, the overall effect of RNA designation would be to provide additional protection and maintenance of natural biological diversity.

Effects of RNA classification on Fish Habitat Management
Habitat manipulation for fish is prohibited unless it is specifically needed to restore natural ecosystem conditions. Habitat manipulation is allowed if specifically designed for the protection of threatened, endangered, or sensitive species.

Effects of RNA classification on Fire Management
Of the seven eligible RNAs, only Kenai Lake/Black Mountain has documented occurrences of natural fire. The use of scheduled prescribed fire may be permitted in this area (except where such burning would threaten other values for which the RNA was proposed) to mimic a natural fire regime or to reduce unnatural fuel loads. Fire control techniques will minimize ground disturbance. Natural barriers will be used to confine or contain fire where possible.

Effects of RNA classification on Insects and Disease Management
Natural outbreaks of native insects and disease are allowed to proceed without intervention, unless they are a substantial threat to important resources inside or outside the RNA boundary. Control methods will minimize disturbance. The only known insect or disease problem in any of the proposed RNAs at this time is a spruce bark beetle outbreak affecting the Kenai Lake/Black Mountain area. Whether or not the level of bark beetle activity in the Kenai Lake/Black Mountain area poses a substantial threat to resources inside or outside the RNA boundary is unknown at this time.

Effects of RNA classification on Vegetation Management
Vegetation management manipulation is prohibited, unless it would more closely approximate natural conditions and processes than would be possible otherwise.

Effects of RNA classification on Threatened, Endangered and Sensitive Species Management
Populations of federally listed threatened and endangered species located within any of the proposed RNAs will be protected according to stipulations under the Endangered Species Act and applicable Forestwide standards and guidelines. Sensitive species located within any of the proposed RNAs will be protected by applicable Forestwide standards and guidelines.

Effects of RNA classification on Wildlife Habitat Management
Habitat manipulation for wildlife is generally prohibited unless it is specifically needed to restore natural ecosystem conditions or specifically designed for the protection of threatened, endangered, or sensitive species.

Effects of RNA classification on Lands and Special Uses Management
Permitted special uses including, but not limited to, helicopter landings, fixed-wing flight seeing landings, destination lodge development, and recreational cabin development are not permitted within RNAs. No existing or proposed permitted special use sites occur within any of the eligible RNAs. Historically, special use permits have been issued for helicopter landings in a portion of the Columbia Glacier-Granite Cove eligible RNA. Requests for such permits would be denied in the future if the area becomes established as an RNA since motorized use would not be allowed.

Effects of RNA classification on Utility Corridors/Communication Sites
Utility corridors and communication sites within RNAs are not compatible with RNA objectives and are not allowed. There are no current or planned utility corridors or communication sites within any of the proposed RNAs.

Effects of RNA classification on Recreation/Tourism Management
The Forest Service will not advertise RNAs as destinations for recreation use. However, existing nonmotorized recreation use will be allowed as long as the use does not become a threat to the values for which the RNA was proposed. Current levels of hiking, hunting, fishing, camping, and related low impact uses by the public will be allowed to continue. If resource degradation develops from increased use, the area will be closed to public use until natural ecosystem conditions are restored. Motorized use is not allowed in RNAs.

Effects of RNA classification on Subsistence Management
Nonmotorized subsistence use is allowed within RNAs. If resource degradation develops from increased use, a NEPA and ANILCA Section 810 analysis will be conducted to determine alternatives to eliminate adverse impacts, including, if necessary, closure to subsistence use until natural ecosystem conditions are restored.

Effects of RNA classification on Travel Management
Road construction is prohibited in RNAs. There are no existing or proposed roads or trails within any of the eligible RNAs. Proposed trails have been identified in the Paradise Valley area west of the eligible Wolverine Glacier RNA. It is possible that interest might emerge towards extending such a trail network over the pass above upper Paradise Lake and into the proposed RNA. Such trail construction would not be allowed in the RNA unless it was consistent with the management and research intent for the RNA.

Effects of RNA classification on Facilities Management
Buildings and developed sites are prohibited within RNAs unless they are specifically needed consistent with the management and research intent for the RNA in question. Except for the Wolverine Glacier proposal, there are no known or proposed buildings or structures within any of the eligible RNAs. The following three structures presently exist within the Wolverine Glacier proposed RNA: a small A-frame cabin, a weather station, and a stream gauging station (presently non-operational). All of these structures have been invaluable in supporting the historic research activity within the proposed RNA.

Effects of RNA classification on Special Designations
<u>EVOS Acquisition Areas</u>
None of the RNA proposals occur within the EVOS acquisition areas.

<u>Wild and Scenic Rivers</u>
The only eligible RNA that overlaps with eligible Wild and Scenic Rivers is the Columbia Glacier-Granite Cove area. Under alternatives D and F approximately 2,000 acres of overlap occur between the two designations at Columbia Glacier-Granite Cove. The eligible Wild and Scenic River designation for the overlap area is “Wild” for both alternatives D and F. Overall, Wild River and RNA

management are compatible since both emphasize allowing natural conditions to prevail.

Wilderness

Overall, wilderness and RNA management is compatible since both emphasize allowing natural conditions to prevail. Primary distinctions in management between the two allocations are that nonmotorized recreational use is permitted and trails may be constructed in wilderness. In contrast, recreational use is permitted in RNAs only if the use does not threaten the values for which the RNA was proposed and trails can only be constructed if they contribute to the objectives or to the protection of the RNA.

ANILCA 501(b) Lands

The following three eligible RNAs occur within ANILCA 501(b) lands: Copper Sands, Pete Dahl Slough, and Schwan Glacier Terminus. Copper Sands is a proposed RNA under alternatives C, D, E, and F. Pete Dahl Slough and Schwan Glacier Terminus are proposed RNAs under the No Action Alternative. RNA designation would limit any manipulations of the RNA to activities specifically needed to restore natural ecosystem conditions. Habitat manipulation is allowed if specifically designed for the protection of threatened, endangered, or sensitive species.

Effects of RNA classification on Timber Management

RNAs are not available for timber harvest. Table 3-63 lists the tentatively suitable acres in each of the eligible RNAs.

Table 3-63: Summary of tentatively suitable timber acres within designated (Green Island) and eligible RNAs by alternative.

	Alternative							
Area	**NA**	**Preffered**	**A**	**B**	**C**	**D**	**E**	**F**
Green Island	0	0	0	0	0	0	0	0
Columbia Glacier-Granite Cove	770		.	.	.	770	770	770
Copper Sands	0	0	.	.	0	0	0	0
Kenai Lake/Black Mountain	490	660	.	660	660	660	660	660
Wolverine Glacier	0	0	.	.	.	0	0	0
Cedar Bay	.		.	770	770	770	770	770
Cutoff Creek	.		.	.	.	1,010	.	1,010
Olsen Creek	.	980	.	980	980	980	980	980
Blackstone Glacier	0		.	.	.	.	.	.
Harvard Glacier	0		.	.	.	.	.	.
Pete Dahl Slough	0		.	.	.	.	.	.
Schwan Glacier Terminus	0		.	.	.	.	.	.
Total	**1,260**	**1,640**	**0**	**2,410**	**2,410**	**4,190**	**3,180**	**4,190**

Effects of RNA classification on Minerals Management

There has been little minerals activity in any of the proposed RNAs. If locatable minerals are identified within any of the proposed RNAs, upon establishment, the Regional Forester (following FSM 4063.35, R-10 Supplement 4000-93-1) will consider whether to request the Bureau of Land Management to withdraw the

area(s). Such decisions will be based on recommendations made by the Regional Research Natural Area Committee, based on several factors, including:

- the extent of mineral resources believed to be located in the area;
- the extent and value of any valid existing rights to such minerals;
- the likelihood that mineral development will occur in the area in the foreseeable future;
- the potential disruption of research use of the area resulting from mineral development; and,
- the cost and administrative burden of requesting and processing the mineral withdrawal.

Oil and gas leasing is unavailable in the proposed RNAs. However, the impact on oil and gas leasing is minimal since the proposed RNAs are within areas that have been identified as having no or low potential for oil and gas development.

Extraction of salable minerals (sand, gravel, hard rock for crushing, and landscape materials) would not be allowed in RNAs. There is abundant mineral material available on the Forest outside of the RNAs.

Cumulative Effects

There are many areas adjacent to the Chugach National Forest where ecological processes are largely unaffected by human influences; Wrangell-Saint Elias National Park and Preserve (largely Wilderness), Kenai Fjords National Park, and designated Wilderness on the Kenai National Wildlife Refuge. Designation of RNAs will add to the acreage on the Forest where ecological processes are largely unaffected by human influences. This could positively affect biological diversity on the Forest by providing a larger area allocated to prescriptions where ecological processes are largely unaffected by human influences.

Cumulative effects resulting from designation of RNAs would include present and future loss of commodity production (principally wood products) and the loss of fish and wildlife habitat enhancement opportunities. Recreational pursuits in the future could be affected by some of the limitations prescribed by RNA direction on types of recreation allowed and limits on accessibility.

Roadless Areas

Introduction

Management of roadless land on the Chugach National Forest is a significant concern with the public, as expressed by issues on sustaining ecosystems, protecting fish and wildlife habitat, designating undeveloped areas for motorized and nonmotorized recreation, maintaining natural quiet areas, and protecting scenic quality. While there is no single designation that applies to roadless area management, many Category 1 and 2 management area prescriptions are applied to areas that are considered roadless. The common theme of these prescriptions is that they prohibit or limit road construction and other activities that would significantly alter the landscape.

Legal and Administrative Framework

- The **National Forest Management Act of 1976 (NFMA)** planning regulations requires the consideration of several criteria in evaluating roadless lands.
- **Forest Service's Roadless Area Conservation Rule (36 CFR Part 294)** – The Forest Service is reevaluating its Roadless Area Conservation Rule (36 CFR 294) and is currently enjoined from implementing all aspects of the rule by the U.S. District Court, District of Idaho (U.S. District Court for the District of Idaho 2001). The Forest Service issued interim direction for Roadless Area Protection in July 2001. The Chugach National Forest will manage inventoried roadless lands consistent with the disposition of the final rule.

Key Indicators

- Number of acres managed for roadless values
- Number of roadless acres managed with roads
- Number of roadless acres actually disturbed by roads

Resource Protection Measures

Roadless areas will be managed through Revised Forest Plan management area prescriptions, standards and guidelines.

Affected Environment

Introduction

An updated roadless inventory divided the Forest into 16 roadless areas totaling 5,434,710 acres. This is about 99 percent of the Forest's total acres. About 57,000 acres of the Forest are considered roaded. Table 3-74, in the Wilderness Section, displays the 16 roadless areas, their acreage and any special

designations applicable to the area. Individual reports on each roadless area are found in Appendix C.

Current Management

Consistent with congressional intent for the Nellie Juan-College Fiord Wilderness Study Area, 1984 Forest Plan direction is to manage the Nellie Juan-College Fiord area to maintain its presently existing wilderness character (1980) and potential for inclusion in the National Wilderness Preservation System.

Hinchinbrook Island, the Russian River/ Resurrection River area, and the Eastern Copper River/Martin River areas are managed under the 1984 Forest Plan as Primitive II ROS class designation. Road building (except for valid existing rights) is not permitted.

Other areas in the Forest had no specific direction to maintain their roadless character. Topographic and economic constraints, and standards and guidelines in the Revised Forest Plan protect many of the roadless area values.

As required by the 1982 CNI Settlement Agreement, Chugach Alaska Corporation (CAC) has been granted an easement to construct a road from the Copper River Highway to their lands near Carbon Mountain (Chugach Alaska Corporation 1999a). The 30-mile road would cross through the Bering Lake Roadless Area. This road corridor (1/4 mile either side of the road) was not included in the roadless area acreage. There is also a right-of-way to CAC from the Katalla area northward to private lands in the Lake Kushtaka area. This road corridor (1/4 mile either side of the road) was not included in the roadless area acreage.

The Montague Island Roadless Area had a 37-mile special use road that was not open to the public. This road has been closed and obliterated. This area is now included in the Montague Roadless Area.

Environmental Consequences

Table 3-64 displays, by alternative, the acres of lands managed to maintain their roadless values (roadless), the acres of land that may be roaded based on specific standards and guidelines found in the management area prescriptions (conditional), and acres of roadless lands where roads maybe necessary to meet the management intent of the area (roads allowed). During the planning horizon (50-years) only a small percent of the acres available for roading are likely to be roaded.

Table 3-64: Acres of roadless areas potentially affected by management activities (M acres).

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Roadless	2,713	5,285	2,166	3,926	4,989	5,068	5,117	5,435
Roads Conditional	137	133	0	112	203	320	298	0
Roads Allowed	2,585	17	3,269	1,397	243	47	19	0
Total	**5,435**	**5,435**	**5,435**	**5,435**	**5,435**	**5,435**	**5,435**	**5,435**

All of the alternatives retain much of the roadless characteristics of these roadless lands that contribute to the unique character of the Chugach National Forest. Under Alternative F, there would be no road construction and reconstruction activities including temporary road construction in any inventoried roadless area. The Preferred Alternative allocates 97 percent of the inventoried roadless land to management area prescriptions that limit road construction. Alternative C allocates 92 percent, Alternative D, 93 percent, and Alternative E, 94 percent. The No Action Alternative and Alternatives A and B allocate the least amount of roadless areas to management prescriptions which retain roadless values. The No Action Alternative allocates 50 percent, Alternative A, 40 percent and Alternative B, 72 percent.

Under the Preferred Alternative, 149,960 acres are in management area prescriptions that permit the Forest Service to construct roads:

Prescription	Roadless Area	Acres
312 – Fish, Wildlife, and Recreation	Johnson Pass	11,940
	Kenai Lake	38,790
	Kenai Mountain	43,080
	Nellie Juan	130
	Resurrection	38,190
	Twentymile	720
314 – Forest Restoration	Resurrection	17,110

All of these areas are on the Kenai Peninsula. Many of these areas were allocated to these prescriptions to treat the spruce beetle epidemic. About 2,000 acres of roadless lands could be affected during the first decade (Table 3-65).

The Forest Service is reevaluating its Roadless Area Conservation Rule (36 CFR 294) and is currently enjoined from implementing all aspects of the rule by the U.S. District Court, District of Idaho (U.S. District Court for the District of Idaho 2001). The Forest Service issued interim direction for Roadless Area Protection in July 2001. The Chugach National Forest will manage inventoried roadless lands consistent with the disposition of the final rule.

Management area allocation or prescriptions themselves would not directly affect the character of any roadless area until a planned activity is implemented (e.g. road construction, recreation construction, timber harvest, mineral development). Under all alternatives, activities that would reduce the current roadless areas over the 50-year planning period would occur at a very slow pace. For example,

that over the first 100 years of the Chugach National Forest, only one percent of the Forest has been developed. Table 3-65, shows the projected acres of roadless lands at the end of the first decade and 50-year planning period by alternative. Actual development might be less depending on several factors including the demand for forest products, the schedule of recreation construction, and potential mineral development in areas with approved plans of operation. Roadless areas might also be affected by unforeseeable activities including mineral development outside of areas with currently approved plans of operation, or at a scale larger than projected, and additional access to private inholdings (outstanding rights).

Projections of actual development were based on the number of miles of new road construction under each alternative. The following assumption was use in this projection: 80 percent of the timber roads, 10 percent of the facilities roads, and 100 percent of the other roads would be constructed in roadless areas. Under Alternative F, no road construction would be permitted in the unroaded portion of any inventoried roadless area. It was estimated that each mile of new road construction would indirectly affect one square mile or 640 acres of roadless land. Actual effects may be more or less. Without the specific location of a road in relationship to the roadless area, it is not possible to accurately determine the effect. For example, if a new road were built near and parallel to a roadless area boundary, very few roadless acres would be affected. On the other hand if a road were built through the middle of a roadless area, many more acres would be affected. In some instances, the new road may even fragment the roadless area.

Table 3-65: Acres of roadless lands affected by roads.

	Alternative							
	No Action	**Preferred**	**A**	**B**	**C**	**D**	**E**	**F**
First Decade	2,400	2,000	43,500	29,400	1,800	1,400	1,000	0
Fifth Decade	118,400	10,000	217,600	147,200	9,000	7,000	5,000	0

Alternative F would retain 100 percent of the inventoried roadless lands. The Preferred Alternative, and Alternatives C, D, and E would retain about 99.8 percent of the existing roadless land during the 50-year planning horizon. The No Action Alternative would retain 97.8 percent; Alternative B, 97.1 percent; and Alternative A, 96.0 percent. Under all alternatives, the Wilderness capability would be retained on all or most of the roadless lands on the Chugach National Forest.

As roadless areas are developed, the apparent naturalness of the area would change, as human activities would dominate small portions of a roadless area. There would also be a loss of remoteness and opportunity for solitude. Some special features and places may be affected. Those wildlife species that depend

on large expanses of undeveloped country may be affected. Roads could fragment some areas and boundaries could be more difficult to manage.

It may be possible to mitigate the loss of roadless characteristics in some situations. The applicability and practicality of mitigation measures depends on the site-specific information and analysis. Possible mitigation includes road closure or obliteration, after the management need for the road is concluded.

Cumulative Effects

The Chugach National Forest is adjacent to many areas managed for their wilderness or roadless values. These areas include Chugach State Park, Kenai Fjords National Park, Kenai National Wildlife Refuge (two designated Wildernesses), and Wrangell-St. Elias National Park and Preserve (largely Wilderness). Many other adjacent lands are roadless because of their topography. As tourism and populations increase in Southcentral Alaska, there will be increased pressures on roadless areas for a variety of uses. However, much of the Chugach would remain roadless because of its rugged topography and glacier features.

Access Management

Introduction

Access is associated with almost every activity that takes place on the Chugach National Forest. Access has been identified as one of the most important situations for the Revised Forest Plan to address. Access is necessary for outdoor recreation, suppressing wildland fires, managing fish and wildlife, removing natural resources such as timber products and minerals, gathering fuel wood, accessing private in-holdings, maintaining electronic sites and utility corridors, and managing the Forest in general.

Access management is a tool used to facilitate the movement of people and products. It provides opportunities for the activities listed above and protects resources, mitigates impacts, and minimizes conflict. Modes of access on the Forest include motorized and nonmotorized means ranging from large commercial trucks and automobiles to aircraft and boats to bicycles to horses to foot travel. Much of the access to the Forest is not by road but utilizes other motorized (aircraft, boat, snowmachine) and nonmotorized (horse, foot, ski) methods. These various forms of travel may occur on paved highways, gravel and dirt roads, trails designated for motorized and/or nonmotorized use; rivers, lakes, and saltwater; and general cross country travel. Motorized surface travel off roads and trails is permitted only in winter with adequate snow cover (primarily snowmachines) unless an area is expressly designated open by a Forest Order. Limited areas have been designated open to summer off highway vehicle (OHV) type use on the Kenai Peninsula and portions of the Copper River Delta.

Access analysis is an integrated ecological, social and economic approach to transportation planning, addressing both existing and future roads and trails. It displays and describes management opportunities for changing the current road and trail system to better address future needs, budgets and environmental concerns (USDA Forest Service 1999d). The access analysis is summarized here and presented in full in the Revised Forest Plan, Appendix B.

Legal and Administrative Framework

- The **Forest and Rangelands Renewable Resource Planning Act of 1974, as amended, Section 10** provides for a proper transportation system to service the Forest.
- The **National Forest Management Act of 1976 (NFMA)** directs the Secretary of Agriculture to specify guidelines for land management plans to ensure protection of national forest resources.

- The **Alaska National Interest Lands Conservation Act of 1980 (ANILCA), as amended**, provides a variety of access rights and allowed motorized uses for subsistence, traditional activities and several specified uses on Conservation System Units and federal lands.
- **Executive Order 11644, as amended by Executive Order 11989,** established the direction for use of off-road vehicles on public lands.
- **36 CFR 219.21** provide for the classification of areas and trails on National Forest System lands as to whether off-road vehicles may be permitted.
- The **Roads Analysis Policy of January 12, 2001** provides a final policy governing the National Forest Transportation System.

Key Indicators

- Acres available for off-road motorized and nonmotorized activities by season
- Miles of new road construction
- Total miles of trails available for motorized and nonmotorized activities by season
- Acres available for helicopter activities by season

Resource Protection Measures

Specific resource mitigation measures for development of access routes are stipulated in the Forestwide standards and guidelines and will be further identified in project level analysis prior to any development of new access or changes in existing access.

Affected Environment

Access management includes all roads, trails and commonly used areas on the Chugach National Forest.

Forestwide

Developed access within the Chugach National Forest is limited. Most roads and trails are concentrated on the Kenai Peninsula. There are no public roads in Prince William Sound and only one main road on the Copper River Delta. The same applies to trails, which are most concentrated on the Kenai Peninsula, with a few in Prince William Sound and on the Copper River Delta. In Prince William Sound, the protected marine waters provide access for all types of boats and float planes. Lakes throughout the Forest provide access for floatplanes and rivers for jet boats and airboats. In summer overland travel is very difficult without developed routes as glaciers and glacier streams, steep mountainous terrain and dense alder thickets make travel very difficult even for the most

adventurous. In winter, access is a little better. With adequate snow cover, much of the Forest is accessible by snowmachine or skiing. Steep terrain still limits access in many areas, so Forest visitors are often concentrated in areas resulting in user conflicts. The interests surrounding access are generally focused on recreation related access.

Current access management can best be described by seasons, as there is a significant difference between summer and winter access.

Areas

In summer (snow-free periods), the Forest is closed to all cross-county motorized travel. During this period, four-wheeled vehicles, trail bikes, and OHVs are allowed on existing roads, power line rights-of-way, and some outwash plains. Most trails on the Kenai Peninsula are closed to motorized use during this period.

In winter (generally December 1 – April 30) with adequate snow cover, the Forest is open to over-the-snow machines, with a few exceptions.

The following areas are currently closed yearlong to all motorized vehicles including over- the-snow-machines:

> Copper River Delta - all areas south of the Copper River Highway extending from Mountain Slough eastward across the Copper River to the base of Ragged Mountains. The closure includes Martin Lake and Little Martin Lake.
>
> Girdwood – the drainages of Crow Creek, Glacier Creek, Winner Creek, and Virgin Creek to the edge of the muskeg meadow near the Forest boundary.
>
> Turnagain Pass – the area bordered on the west by Ingram Creek and the Seward Highway to the Johnson Pass Trailhead Road (#927), on the south by Center and Divide Creek, and on the east by the divide separating the area from the Placer River Valley.
>
> Manitoba Mountain – the area bordered on the west by Canyon Creek and the Forest boundary, on the north by Wilson Creek, on the south by Mills Creek Road (#923) and Juneau Creek, and on the east by the ridge line formed by Manitoba Mountain.
>
> Hinchinbrook and Montague Islands – both these islands are closed to all motorized vehicles, except for an area south of Boswell Bay that is open to OHV use on un-vegetated sand dunes.
>
> Portage Valley – the area east of the parking lot at the head of Portage Valley, including Portage Lake, Bear Valley, Byron Valley and Portage, Burns, and Byron Glaciers. Portage Lake is closed to all water, ice, and airborne craft; except point-to-point boat travel is allowed along the northwest shore, between the source of Portage Creek and the outlet of Placer Creek in Bear Valley.

Roads

The Chugach National Forest has a very limited road network. The road system on the Forest totals about 285 miles. State highways (such as Sterling and Seward) and Forest highways (such as Portage, Copper River, Hope and Exit Glacier) are the backbone of the road system. There are 100 miles of state highways and 75 miles of Forest highways on the Chugach National Forest.

There are also 97 miles of Forest Development Roads and 13 miles of Unclassified Roads on the Chugach (Table 3-66). Most Forest Development Roads are concentrated in the valley bottoms. They include roads that access developed sites like campgrounds, trailheads and administrative sites; roads built under a special use permit; and roads developed for resource activities, such as timber sales. Some of these roads are currently closed to vehicle travel, but available for nonmotorized use. Most roads are gravel surfaced, receiving minimal annual maintenance beyond grading. Roads under special use permit are maintained by the permittee. In addition, a 30-mile road easement has been granted to construct the Carbon Mountain Road on the Copper River Delta. (Carbon Mountain Access Road, Chugach Alaska Corporation, MOU of March 1998).

Table 3-66: Miles of inventoried road.

Geographic Area	Miles of Road	Miles Restricted[1]	Miles Open[2]
Kenai Peninsula	91	35	56
Prince William Sound	1	1	0
Copper River Delta	18	0	18
Total	**110**	**36**	**74**

[1] Restricted to OHV or nonmotorized uses; open to vehicle use only for specific management activities
[2] Some miles may be restricted seasonally i.e. unplowed roads

Trails

Trails have been developed for access throughout the Forest, with most trails concentrated on the Kenai Peninsula. Currently, all trails on the Kenai Peninsula are closed to summer motorized uses. In winter, most are open to over-snow motorized travel.

Trails provide access to unroaded areas, typically beginning from an existing road or saltwater shore. Access to fishing and hunting activities, many Forest Service cabins, and winter skiing or snow machining are facilitated with trails. Currently there are approximately 555 miles of trails including user-developed trails and marked easements (see Table 3-67). Trails standards range from very highly developed to primitive routes marked with blazes. About 50 percent of the trails receive annual maintenance such as brushing and trail tread work (culvert cleaning, water bars etc.) with heavier maintenance done as needed.

Table 3-67: Miles of inventoried trails.

Geographic Area	Miles of Trail	Summer Motorized	Summer Nonmotorized	Winter Motorized[1]	Winter Nonmotorized
Kenai Peninsula	362	20	342	267	151
Prince William Sound	88	0	88	0	88
Copper River Delta	105	4	101	78	75
Total	**555**	**24**	**531**	**345**	**314**

[1] Some trails have seasonal winter closures for motorized use.

There are 91 miles of roads in the Two Moon Bay area not included in this table. This area was acquired through the *Exxon Valdez* oil spill restoration program. The Forest is currently developing a watershed rehabilitation plan for the area.

Environmental Consequences

General Effects

In all alternatives, existing developed access routes within the Forest will be maintained and new access routes may be developed. The primary difference is the number of new access routes anticipated to be developed and whether these access routes allow for motorized or nonmotorized activities. The alternatives also vary in the number and size or areas closed to motorized cross-country travel, both summer and winter.

Direct and Indirect Effects

Access management direction on the Forest generally allows motorized use on roads, trails and areas unless a Forest Order specifically restricts or closes it.

There are two main factors affecting access: (1) the effect from changing management area prescriptions, and (2) the effect from new road construction and road obliteration. Because the Chugach Forest has so few roads, few roads are planned for obliteration under any alternative. Some existing roads may be converted to trails, but the access would remain.

Effects from Management Prescriptions

Management area prescriptions would have the greatest effect on Forest access. Category 1 and 2 prescriptions would not allow new Forest Service roads. Alternatives with a higher percentage of these prescriptions would allow for less road-developed access. All prescriptions, except 142 – Natural Processes, allow for new trail construction. Alternatives vary in the areas allowing motorized or nonmotorized activities. Category 1 and some Category 2 prescriptions are nonmotorized. Complicating the Motorized/Nonmotorized Access Interest are seasonal exceptions to the base prescriptions, allowing or not allowing motorized uses seasonally. Table 3-68 shows the acres of the Forest that would be available for motorized and nonmotorized recreation in the summer and winter by alternative.

Table 3-68: Gross acres available for access, motorized and nonmotorized activities[1] (M acres).

		Alternative							
		No Action	Preferred	A	B	C	D	E	F
Kenai Peninsula	Acres/Percent Summer Motorized[2]	1,056 90%	423 36%	1,173 100%	1,074 92%	425 36%	228 19%	244 21%	272 23%
	Acres/Percent Summer Nonmotorized	1,173 100%	1,173 100%	1,173 100%	1,173 100%	1,173 100%	1,173 100%	1,173 100%	1,173 100%
	Acres/Percent Winter Motorized	1,169 99%	963 82%	1,173 100%	1,103 945	935 80%	491 42%	957 82%	981 84%
	Acres/Percent Winter Nonmotorized	1,173 100%	1,173 100%	1,173 100%	1,173 100%	1,173 100%	1,173 100%	1,173 100%	1,173 100%
Prince William Sound	Acres/Percent Summer Motorized[2]	485 18%	242 9%	2,538 97%	1,347 51%	846 32%	663 25%	343 13%	71 3%
	Acres/Percent Summer Nonmotorized	2,625 100%	2,625 100%	2,625 100%	2,625 100%	2,625 100%	2,625 100%	2,625 100%	2,625 100%
	Acres/Percent Winter Motorized	2,027 77%	2,205 84%	2,538 97%	2,212 84%	2,015 77%	2,040 78%	2,010 77%	2,289 87%
	Acres/Percent Winter Nonmotorized	2,265 100%	2,625 100%	2,625 100%	2,625 100%	2,625 100%	2,625 100%	2,625 100%	2,625 100%
Copper River Delta	Acres/Percent Summer Motorized[2]	1,236 73%	625 37%	1,675 99%	1,323 78%	449 26%	280 17%	380 22%	244 14%
	Acres/Percent Summer Nonmotorized	1,694 100%	1,694 100%	1,694 100%	1,694 100%	1,694 100%	1,694 100%	1,694 100%	1,694 100%
	Acres/Percent Winter Motorized	1,236 73%	1,623 96%	1,676 99%	1,324 78%	1,078 64%	1,635 97%	1,649 97%	1,647 97%
	Acres/Percent Winter Nonmotorized	1,694 100%	1,694 100%	1,694 100%	1,694 100%	1,694 100%	1,694 100%	1,694 100%	1,694 100%

[1] Actual acres available may be less due to terrain and seasonal limits.
[2] Summer motorized activities are limited to designated routes, trails or areas.

Effects from Timber Management

Access for timber management would consist mostly of short local roads. About 80 percent of these roads would be built in roadless areas of the Forest. These roads would remain open for public use and continued management of timber resources. Only Alternatives A, B and No Action would have road construction for timber management. Table 3-69a shows the miles of new road construction for timber management at the end of the first decade.

Table 3-69a: New roads for timber management at the end of first decade (miles).

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Kenai Peninsula	13	0	15	9	0	0	0	0
Prince William Sound	22	0	32	21	0	0	0	0
Copper River Delta	9	0	34	4	0	0	0	0
Total	**44**	**0**	**81**	**34**	**0**	**0**	**0**	**0**

Effects from Recreation/Tourism Management

The vast majority of access interests relate to recreation/tourism uses and activities. People are seeking the "Alaska Experience" in a variety of ways and in large and small groups. The classic conflict between motorized and nonmotorized users, especially in winter, is the dominant access situation for the Revised Forest Plan to address. Additional interests where access is a key element are for horses, bicycles, heli-skiing and hiking, and boats as means of access. Access for recreation activities is of interest to people of all levels of ability. Appendix F displays how motorized access (highway vehicles, high clearance vehicles, off road vehicles, motorcycles, and snowmachines) and nonmotorized access (horses, hikers, skiers, bicycles and dog sleds) would be managed under each alternative.

The alternatives provide a broad range and level of potential access to the Forest. Alternatives A and B would provide a more aggressive, developed network of roads and trails and more opportunities for motorized access in summer and winter. Alternatives E and F would provide trails and emphasize summer nonmotorized and a mix of motorized and nonmotorized winter access. In all alternatives, horses and bicycles would be allowed on many trails beginning on July 1 of each year. See the Access Plan in Appendix F for specific trails. There is currently a closure on horse use on Kenai Peninsula trails from April 1 – June 30.

In all alternatives, there is new road construction proposed with the development of recreation and administrative facilities. Most of these roads are expected to be small segments to new recreation developments, such as campgrounds, trailheads, and viewpoints. Most would be located within existing road corridors on the Kenai Peninsula. Additionally, Alternative B identifies potential roads (16 miles the first decade) into new areas for improved and easier access. All of these roads would be constructed on the Kenai Peninsula. Table 3-69b shows the miles of new road construction for other uses at the end of the first decade. Table 3-70 shows the total miles of trail available at the end of the first decade.

Table 3-69b: New roads for other uses at the end of first decade (miles).

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Kenai Peninsula	18	24	26	41	23	17	11	9
Prince William Sound	1	1	1	1	1	1	1	1
Copper River Delta	3	7	5	5	4	4	4	3
Total	**22**	**32**	**32**	**47**	**28**	**22**	**16**	**13**

Table 3-70: Trail access at the end of first decade (miles available).

Area	Season / Access	No Action	Preferred	A	B	C	D	E	F
Kenai Peninsula	**Winter**								
	Motorized	283	380	427	473	408	308	345	316
	Nonmotorized	185	174	90	89	145	231	136	124
	Total	**468**	**554**	**517**	**562**	**553**	**539**	**481**	**440**
	Summer								
	Motorized	48	14	40	213	101	6	3	3
	Nonmotorized	364	490	421	234	389	483	428	387
	Total	**412**	**504**	**461**	**447**	**490**	**489**	**431**	**390**
Prince William Sound	**Winter**								
	Motorized	0	8	72	75	54	0	0	7
	Nonmotorized	99	138	97	119	140	155	106	91
	Total	**99**	**146**	**169**	**194**	**194**	**155**	**106**	**98**
	Summer								
	Motorized	0	8	0	33	28	0	0	1
	Nonmotorized	99	138	169	161	165	155	106	96
	Total	**99**	**146**	**169**	**194**	**193**	**155**	**106**	**97**
Copper River Delta	**Winter**								
	Motorized	78	101	140	137	111	97	107	103
	Nonmotorized	92	70	42	60	87	83	64	52
	Total	**170**	**171**	**182**	**197**	**198**	**180**	**171**	**155**
	Summer								
	Motorized	4	5	37	36	7	3	3	3
	Nonmotorized	118	117	97	111	144	130	121	106
	Total	**122**	**122**	**134**	**147**	**151**	**133**	**124**	**109**

A key element for nonmotorized access is the ease in getting to a nonmotorized area. Nonmotorized areas located far from easy access are of little use to most nonmotorized users. Ease of access is a function of the proximity to existing roads, trails or communities. Alternatives A and No Action would provide no specific areas exclusively for nonmotorized opportunities adjacent to roads or communities. Alternatives B and C would provide the existing area at Turnagain Pass and Manitoba Mountain and seasonal time-share on Resurrection Pass. Alternatives E and F would allow for traditional activities including motorized uses. Alternative D and the Preferred would provide the most nonmotorized opportunities near existing access and communities. Several areas are specifically identified for nonmotorized activities adjacent to the Seward Highway.

Helicopter access for winter heli-skiing and, to a lesser degree, summer heli-hiking is provided in every alternative. Alternatives A, B and the No Action would make available the greatest amount of area for year-round helicopter access. Alternatives C, D, E, and the Preferred Alternative identify specific areas for winter and summer helicopter activities. Alternatives E and F would limit helicopter access both in winter and summer. Actual acres available for helicopter skiing and hiking by alternative can be found in the planning record. Additional information on roads, trails and areas open/closed to motorized use

(snowmachines and helicopters) can be found in the Recreation and Tourism section of this Chapter.

Cumulative Effects

In the first decade, because the Chugach has such a small network of access routes, the miles of access routes, primarily roads and trails, are anticipated to increase in all alternatives. This would disperse some recreational use to backcountry areas presently receiving little use. Existing roads available for highway vehicles would be maintained and upgraded, consistent with the setting, as use increases. The following may occur:

- use would probably be concentrated on those access routes maintained to a higher standard;
- an increase in maintenance funds would be needed to provide the necessary levels of maintenance to an expanded access net; and,
- as access increases, especially into new areas or the number of users increase because of easier access, the quality of the recreation experience may be changed or reduced. Monitoring will be used to assess these changes and the need to limit or control access or amend the Revised Forest Plan.

Two new roads to be built by others will significantly change the access patterns on the Forest. The new road to Whittier, extending the Portage Highway and replacing the railroad access, is anticipated to result in a dramatic increase in people visiting Whittier and Prince William Sound. Currently, about 200,000 recreational people visit Whittier annually. This is anticipated to increase to over one million people by the end of the decade. While the projected number of visitors has been subject to question, there is universal agreement that there will be a significant increase in people coming to Whittier and going out into the Sound. These people will be seeking access to the Forest once in the Sound.

The second new access is the Carbon Mountain Road in the Copper River Delta. Chugach Alaska Corporation (CAC) proposes to build a 30-mile long road across National Forest System lands to their Bering River Coal Fields tract. A road crossing privately owned lands (with rights of public access) links the proposed road to the Copper River Highway at mile 41. CAC proposes to harvest about 8,000 acres of commercial timber from their lands over the next 10 to 15 years (Chugach Alaska Corporation 1999a). While the road is not built across National Forest System lands, an easement has been granted and construction is anticipated in the very near future. This road will provide easier access to an area of the Forest that is now accessible only by jet and airboats and floatplanes. Prescriptions adjacent to this new road or within the “day use” radius of Whittier will dictate how Chugach National Forest lands may be accessed (see Table 3-71). The alternatives provide a range of access levels to these areas.

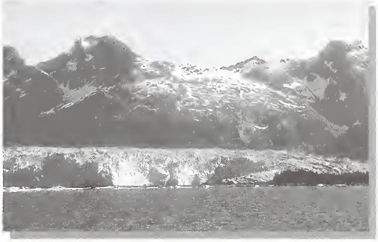
Table 3-71: Dominant prescription adjacent to the Carbon Mountain Road and Whittier.

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Carbon Mountain Road	501(b) - 3	501(b) - Recommended Wilderness and 501(b) - 1	501(b) - 3	501(b) - 2	501(b) - 2	501(b) - Recommended Wilderness	501(b) - Recommended Wilderness	501(b) - Recommended Wilderness
"Day Use" Radius of Whittier	Recommended Wilderness and Backcountry	Backcountry*	Resource Development and Fish, Wildlife and Recreation	Fish, Wildlife and Recreation	Backcountry and Backcountry Motorized	Backcountry	Recommended Wilderness	Recommended Wilderness

Scenery

Introduction

The most prized resource of the State of Alaska and the Chugach National Forest is its scenery. Locals and visitors marvel at its grandeur. The Chugach embodies all the best Alaska's scenery has to offer. From ocean shorelines to snow-covered peaks; dramatic glaciers cascading to the ocean or hanging on mountainsides, crystal clear lakes and rivers as well as the turquoise blue of glacier silt waters; forested mountain slopes giving way to alpine, rock and ice. The Chugach landscape has diversity, complexity and size that take your breath away. It is magnificent and inspiring, yet, at the same time, humbling.



The landscape of the Chugach appears natural and undisturbed by human intervention. The Chugach has been actively managing the scenery since the mid-1970s using the agency's Visual Management System and more recently its replacement, the Scenery Management System. Scenery management was developed to help meet the public's expectation for scenic beauty while allowing for multiple resource use in a way that works with natural processes to achieve a desired landscape condition.

The public has been vocal on the importance of maintaining scenic beauty on public lands. In comments received from the public during scoping and surveys on visitor satisfaction, values and quality of life all consistently rate scenery at or near the top in importance to people.

Managing for scenic quality benefits the regional economy. Tourism is a principle economy for Southcentral Alaska. Numerous studies document that the region's outstanding scenery is a major attraction. Real estate developers understand that homes or residential lots with a view are worth more than those without. The same holds true for hotels. Rooms with a view frequently command a higher price. Campsites with a view fill up first.

Changes in the scenery occur naturally through major events such as avalanches, wildland fires, floods, wind, and insect infestations. The Chugach has experienced these types of events on a regular basis. A major spruce bark beetle outbreak is currently on going and noticeably changing the forest composition on the Kenai

Peninsula. The scenery also changes through human intervention, such as logging, utility construction and facility development.

In the Revised Forest Plan, all landscapes are assigned a Scenic Integrity Objective (SIO) that defines the acceptable degree of alteration from the natural appearing landscape character. Forestwide standards and guidelines provide the direction for implementing SMS

Legal and Administrative Framework

- The **National Environmental Policy Act of 1969 (NEPA)** states that it is the "continuing responsibility of the federal government to use all practicable means to assure for all Americans, aesthetically and culturally pleasing surroundings." NEPA directs agencies to develop practicable methodologies for scenery management of "aesthetically and culturally pleasing surroundings." It also requires "a systematic and interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts into planning and decision-making which may have an impact on man's environment."
- The **Wilderness Act of 1964** directs that Wilderness be managed to retain its primeval character and influences, in its natural condition, with the human imprint in substantially unnoticeable form.
- The **Wild and Scenic Rivers Act of 1968** stipulates that the outstandingly remarkable scenic values of rivers eligible or suitable for inclusion in the system be carefully managed. Any management activities that could negatively affect the "outstandingly remarkable" scenic resources should not be conducted.
- The **National Trails System Act of 1968** states that trails should be established within scenic areas and along historic travel routes of the nation, which are often more remotely located.
- The **Forest and Rangeland Renewable Resources Planning Act of 1974** provides direction to conduct aesthetic analysis and assess the impacts on aesthetics of timber harvesting. It also provides the framework for natural resource conservation.
- The **National Forest Management Act of 1976 (NFMA)** directs that the preservation of aesthetic values be analyzed at all planning levels. Part 219.21 requires visual resources to be inventoried and evaluated as an integral part of evaluating alternatives in the forest planning process, addressing both the landscape's visual attractiveness and the public's visual expectations.

- **Forest Service Manuals, Chapter 2380, Landscape Management** proved Forest Service regulations and policy for visual resources.

Key Indicators

- Acres by Scenic Integrity Objectives (SIO)
- Scenic Integrity Levels

Resource Protection Measure

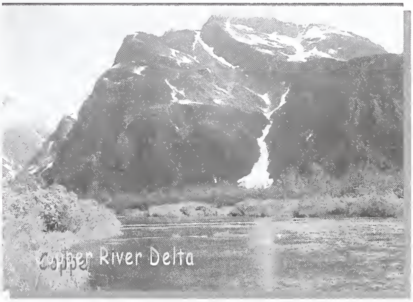
Resource protection is provided for in USDA handbooks for managing the scenery of National Forest System lands.

Affected Environment

Forestwide

The Scenic Resource of the Chugach National Forest is an important component of the total Forest resource base. The 1984 Forest Plan established Visual Quality Objectives (VQO) for the entire Forest. These objectives were intended to maintain the outstanding scenic quality found throughout the Forest. The Forest inventoried the landscape for the entire Forest in 1979. This was the basis for the Visual Quality Objectives adopted in the 1984 Forest Plan.

Changes created by management activities in the viewed landscape of the Chugach National Forest since the late 1970s have been few and mostly on the Kenai Peninsula. The biggest change has occurred from more people going to more places and viewing scenery that previously was seldom seen. Some specific changes that have occurred and have affected the scenery are: several large wildlife habitat improvement areas on the Kenai Peninsula, expanded road corridors as the result of highway reconstruction, powerline upgrades, small timber sales along the Seward Highway corridor, and several site specific changes from new recreation facilities and trails. While there have been numerous other management activities, none have had any effect on the scenery. The viewing of scenery is a major recreation use in and of itself on the Chugach National Forest. It is also a major component in the overall satisfaction of other activities such as hiking, camping, tourism, and fishing.



There has been and continues to be a change occurring to the viewed landscape on the Kenai Peninsula. The spruce bark beetle infestation is changing the forested landscape. The change to the scenery is noticed more by regular users

of the area but is almost invisible to first time visitors. The change is also more noticeable in the foreground and near middleground distances than in background. To most people, the change appears as a natural occurrence and not a negative impact, it is just different. In the context of how the landscape is viewed, the forested portion makes up a small part of the overall view. The mountains, alpine, rock and ice typically dominate the scenery with the forested parts of the view adding overall variety in line, form, color, and texture. To date, the changing scenery has not affected users or use patterns.

Changes in the scenery from the bark beetle will occur (measured in years) as spruce trees die. Much of the Kenai Peninsula has been hit hard by the beetle and is past the initial attack stage with many of the spruce trees dead and without needles. There will be a change in the line, form, color, and texture of the forest. The initial change, when the needles turn rusty red, is the most visible stage. After the needles fall (one season), the gray snags remain standing for 5 - 15 years. In pure forests of spruce, they take on a very gray color and the texture becomes very coarse. In mixed forests, which dominate the Chugach portion of the Kenai Peninsula, this change is not as apparent. Over time, the change will result in a landscape that, while natural appearing, will be different than today. In forests with a lot of spruce, as dead trees fall, these forests will likely be more open with grass and shrub cover dominating.

This change in the scenery will be most apparent in foreground (within ½ mile). The dead spruce and fallen trees will create a "messy" appearance. While considered natural appearing, it is less attractive than "healthy" forests.

The Forest was re-inventoried using the Scenery Management System (SMS) in 1997/98. SMS is a two-part process to 1) assess current scenic conditions and identify the relative importance of the viewed landscape and 2) identify management goals and objectives for managing the viewed landscape in the Forest Plan. The first part involves defining and mapping 5 components to systematically describe the existing scenery and develop Scenic Classes. These 5 components are:

- Existing Landscape Character Descriptions
- Identifying the existing Scenic Integrity
- Identifying the existing Scenic Attractiveness
- Determining the Concern Levels and Landscape Visibility
- Determining the Scenic Classes

The second part involves defining and mapping two components using information developed in the first part of alternative development and planning process. These two components are:

- Landscape Character Goals
- Scenic Integrity Objectives

Existing Scenery Inventory

Existing Landscape Character Description

Landscape character defines a "sense of place" and describes the image or overall impression of a geographical area.

It is a description of the landscape that combines objective physical and biological elements with human elements valued for their aesthetic appeal. The attributes identified provide the frame of reference for defining the scenic attractiveness classes and existing scenic integrity of the landscape by showing what makes each landscape identifiable or unique. There are eight Landscape Characters on the Chugach National Forest:

Kenai Peninsula Geographic Area:

1) Turnagain Arm
2) Central Kenai Mountains
3) Maritime Kenai

Prince William Sound Geographic Area

4) Prince William Sound Fiords
5) Prince William Sound Islands
6) Copper Mountain

Copper River Delta Geographic Area

7) Copper/Bering Rivers
8) Tasnuna/Wernicke Rivers

All eight Landscape Characters are predominately physical and biological with little influence from human cultural attributes. Only the landscape characters on the Kenai Peninsula have any significant cultural influence from human activities.

Existing Scenic Integrity

The valued attributes of the Landscape Character description are used as a frame of reference for determining the existing scenic integrity level (SIL). SIL indicates the degree of intactness and wholeness of the landscape character, and helps locate and rank areas in need of scenic rehabilitation. It serves as a benchmark for monitoring landscapes to assess changes associated with

planned management activities. Conversely, SIL is a measure of the degree of visible disruption of landscape character. A landscape with very minimal visual disruption is considered to have high SIL. Landscapes with increasingly incompatible relationships among scenic attributes are viewed as having diminished SIL. Six terms are used to describe the levels of existing scenic integrity. These levels are expressed and mapped as follows:

- **Very high** - the valued Landscape Character is intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level.

- **High** - the valued landscape character appears intact. Deviations may be present but must repeat the form, line, color, texture and pattern common to the landscape character so that they are not evident.
- **Moderate** - the valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed.
- **Low** - the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed, but they borrow valued attributes such as size, shape, edge effect, and pattern of natural openings, changes in vegetation types, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed, but compatible or complementary to the character within.

- **Very low** - the valued landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect, pattern of natural openings, changes in vegetation type, or architectural styles within or outside the landscape being viewed. However, deviations must be shaped by and blend with the natural terrain so that elements such as

unnatural edges, roads, landings, and structures do not dominate the composition.

- **Unacceptably low** - the valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern, or scale from the landscape character. Landscapes at this level of integrity need to be rehabilitated. This level should only be used to inventory existing integrity. The first five terms are also used to describe the Scenic Integrity Objectives (SIO) adopted in the Revised Forest Plan. The sixth SIL, Unacceptably Low, is never used as an objective for scenery management.

The Chugach National Forest is mostly landscapes with a very high level of scenic integrity. Noticeable deviations in the landscape character are concentrated along the existing travelways of the Kenai Peninsula and are associated with road construction and reconstruction over the years. Additionally, the high voltage transmission line paralleling the Seward Highway reduces the scenic integrity in certain locations when viewed from the Seward Highway. In Prince William Sound and the Copper River Delta, the landscape has few signs of human intervention and is predominantly a very high scenic integrity. The exception is lands recently acquired from the Native village corporations of Tatitlek and Eyak. These lands have been noticeably altered through significant timber harvest activities and have very low scenic integrity.

Figure 3-68 shows the existing scenic integrity levels of the Chugach National Forest.

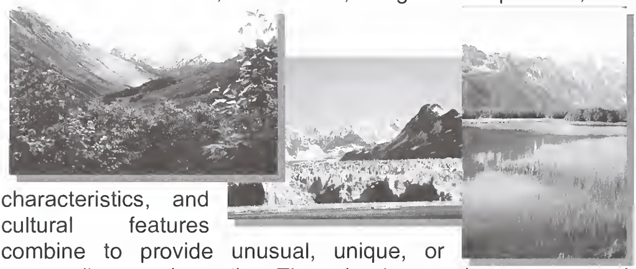
Figure 3-68: Existing scenic integrity.

	Very High	High	Moderate	Low	Very Low
Kenai Peninsula	1,118,130	35,490	18,060	950	120
Prince William Sound	2,546,18	1,520	21,050	8,500	47,890
Copper River Delta	1,691,950	-	1,330	90	320

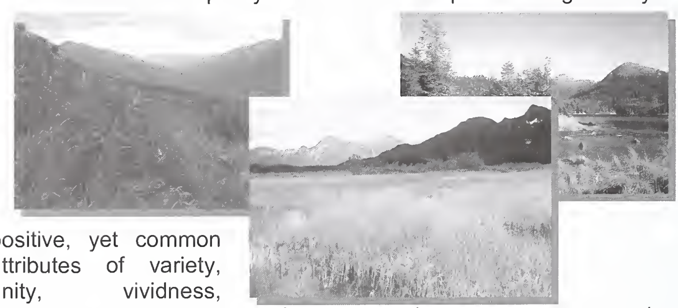
Scenic Attractiveness

Scenic attractiveness is the primary indicator of the inherent scenic beauty of a landscape and of the positive responses it generates for people. It helps determine which landscapes are valued for scenic beauty, based on commonly held perceptions of the beauty of landforms, vegetation pattern and composition, water characteristics, land-use patterns and cultural features. Scenic attractiveness indicates varying levels of long-term beauty of the landscape character. The three scenic attractiveness classifications are (1) Class A - distinctive, (2) Class B – typical, and (3) Class C – Indistinctive.

- In Class A areas, landforms, vegetation patterns, water characteristics, and cultural features combine to provide unusual, unique, or outstanding scenic quality. These landscapes have strong positive attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.



- In Class B areas, landforms, vegetation patterns, water characteristics, and cultural features combine to provide ordinary or common scenic quality. These landscapes have generally positive, yet common attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.



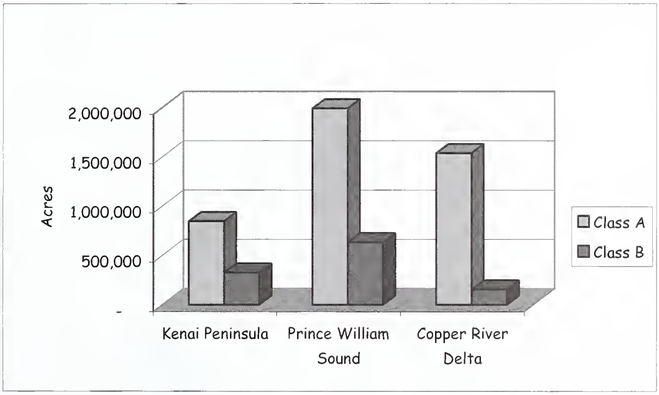
- In Class C areas, landforms, vegetation patterns, water characteristics, and cultural land use have low scenic quality. Often water and rockform of any consequence are missing in Class C landscapes. These landscapes have weak or are missing attributes of variety, unity, vividness, mystery, intactness, order,

harmony, uniqueness, pattern and balance. There are no Class C landscapes on the Chugach National Forest.

There is a reason people come to Alaska and the Chugach National Forest. The scenery is outstanding throughout the Forest. The scenery of the Chugach National Forest is predominantly Class A. The combination of forest and alpine vegetation patterns, rocky peaks, glaciers, numerous lakes and waterfall, the ocean, steep mountains and the scale and grandeur of the landscape combine to create a landscape high is attractiveness. In those places where the landscape is not quite as interesting, it is still considered Class B. The Chugach National Forest has no Class C landscapes.

Figure 3-69 shows the Scenic Attractiveness of the Chugach National Forest.

Figure 3-69: Scenic attractiveness.



Landscape Visibility

Landscape visibility identifies the relative importance and sensitivity of what is seen and perceived in the landscape. Landscape visibility is a function of many essential, interconnected considerations, including: (1) context of viewer; (2) duration of view; (3) degree of discernible detail; (4) seasonal variations; (5) number of viewers; and (6) viewers' level of concern for scenic quality.

Other natural resource values, such as wilderness, wildlife, or old-growth forest, may create needs for natural appearing landscapes and ultimately may raise the importance of maintaining high levels of scenic quality and landscape settings. These other natural resource values relate to viewer context. Sometimes only a small number of people view certain landscape, but these people have high concern for scenic quality and high expectations of outstanding scenic beauty. When associated with other related experience/opportunities such as spiritual quests, introspection, and so on, these landscapes have even higher scenic

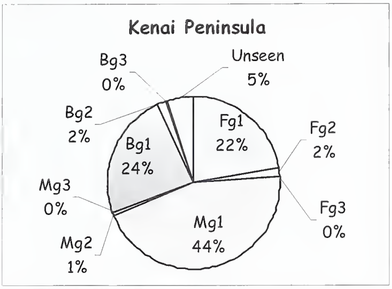
importance and value. The importance of these landscapes is even greater if these other related experience/opportunities are available only occasionally.

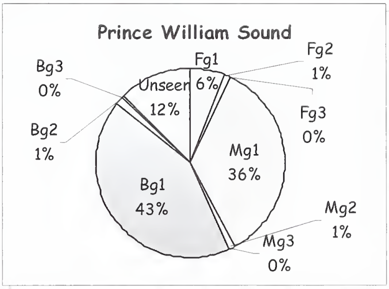
Landscapes seen close-up are more visually sensitive than those seen in muted detail from greater distances.

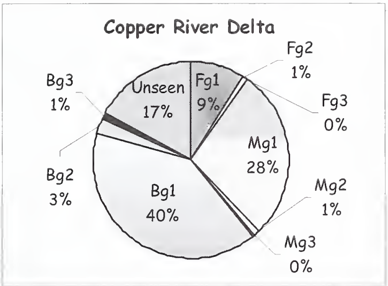
To do the landscape visibility analysis, the geographic information system (GIS) was used to identify the visible lands. Using various data layers, all the places from which the Forest is viewed were identified and assigned a concern level from 1 (most important) to 3 (least important). This included all roads and trails, developed sites, lakes and streams, and any other known places people use. The computer then did an analysis of lands visible from these identified points and lines, by distance zones. The end result was a map of all lands visible, the concern level of those visible lands and the distance from which they are viewed. Lands identified as unseen are generally not visible from identified travel routes and use areas.

Figure 3-70 shows the distance zones and concern levels assigned to the Forest as a result of the visibility analysis.

Figure 3-70: Landscape visibility analysis by geographic area.







Acres	Fg1	Fg2	Fg3	Mg1	Mg2	Mg3	Bg1	Bg2	Bg3	Unseen
Kenai Peninsula	261,660	18,380	20	522,980	12,220	70	276,500	19,180	2,060	59,680
Prince William Sound	156,030	25,690	3,070	923,230	29,430	3,620	1,113,930	37,290	6,610	326,240
Copper River Delta	150,530	13,000	510	475,150	18,600	5,300	680,630	45,160	15,920	288,890
Forestwide	568,220	57,070	3,600	1,921,360	60,250	8,990	2,071,060	101,630	24,590	674,810

Fg = Foreground, 0 – ½ mile; Mg = Middleground, ½ - 5 miles; Bg = Background, 5+ miles
1 = Concern Level 1; 2 = Concern Level 2; 3 = Concern Level 3

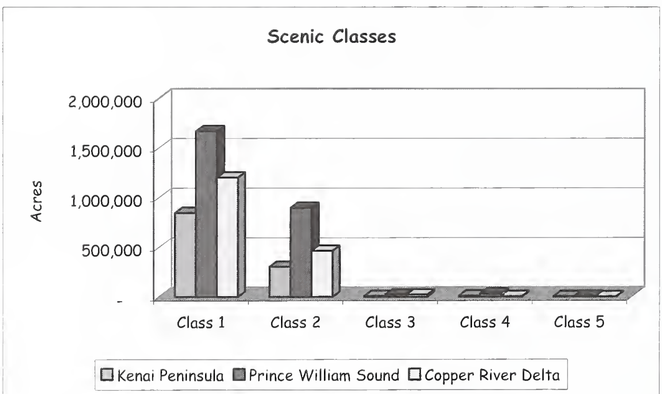
Scenic Classes

Scenic classes represent the relative landscape value by combining distance zones, concern levels, and scenic attractiveness. Using the data gathered and mapped for scenic attractiveness and landscape visibility, a numerical scenic

class value is assigned to National Forest System lands. The mapped scenic classes are used during forest planning process to develop the Scenic Integrity Objectives for each alternative. There are seven scenic classes. Generally, scenic classes 1 and 2 have the highest importance and scenic value, classes 3 through 5 have moderate importance and scenic value, and classes 6 and 7 have low importance and scenic value. The Chugach National Forest has classes 1-5 only. Based on the scenic classes inventory, over 95 percent of the Forest has high scenic value.

The scenic classes represent the end of the inventory process. Scenic Integrity Objectives for each alternative are identified during alternative development using the Scenic Classes for guidance and applying the proposed management area prescription intent. Figure 3-71 shows the scenic classes of the Forest.

Figure 3-71: Scenic classes.



Environmental Consequences

Development of Management Objectives

While the previous section described the inventory process and the status of scenery on the Chugach National Forest, this section will briefly describe the elements that are used in the planning process, including analysis, leading to direction for management of the scenery on the Forest.

Landscape Character Goals

The landscape character goals are a description of the desired landscape attributes to be managed for into the future. Specific landscape attributes to achieve the goal are written directly into the management area prescriptions. Some deviation from the current natural appearing character is permitted in some management area prescriptions. While all the alternatives will maintain the overall natural appearing character of the landscape, some site-specific reduction in the natural appearing character may occur in alternatives that emphasize more resource extraction activity.

Scenic Integrity Objectives

Scenic Integrity Objectives (SIO) identify the specific management direction for managing the scenery of the Chugach National Forest in relation to the Landscape Character. Each management area prescription will have a specific range of SIOs tailored to the management objectives of the prescription. Each alternative will have a specific set of mapped SIOs based on the management area prescriptions of the alternative (Table 3-72). Scenic Integrity Objectives are mapped for the each alternative within the range of SIOs for each prescription and the Scenic Class. These identify the degree of change from the natural character that will be allowed for any area. Specific project analysis will address the actual design requirements necessary to maintain the scenic quality within the Scenic Integrity Objective.

Table 3-72: Scenic integrity objectives range by prescription.					
	Scenic Integrity Objective (SIO)				
Prescription	Very High	High[1]	Moderate	Low	Very Low
111 - Primitive					
121 - Wilderness Study Area					
131 - Recommended Wilderness					
132 - Wild River					
133 - 501(b) - Recommended Wilderness					
135 - 501(b) - 1					
141 - Research Natural Area					
142 - Natural Processes					
210 - Backcountry*					
211 - Backcountry					
Nonmotorized Emphasis					
Winter Motorized Emphasis					
Winter and Summer Motorized Emphasis					
212 - Backcountry Motorized					
Winter Motorized Allowed					
Winter and Summer Motorized Allowed					
213 - 501(b) - 2					
Winter Motorized Allowed					
Winter and Summer Motorized Allowed					
221 - EVOS Acquired Lands					
231 - Scenic River					
241 - Municipal Watershed					
242 - Brown Bear Core Area					
244 - Fish and Wildlife Conservation Area					
312 - Fish, Wildlife and Recreation		Fg 1 Only			
313 - Backcountry Groups					
314 - Forest Restoration		Fg 1 Only			
321 - 501(b) - 3		Fg 1 Only			
331 - Recreational River					
341 - Developed Recreation - Reduced Noise					
411 - Resource Development		Fg 1 Only			
441 - Developed Recreation Complexes					
521 - Minerals (site specific)					
522 - Major Transportation / Utility Systems (site specific)					

[1] Fg 1 Only means Foreground Concern Level 1 described in FEIS, Chapter 3, Uses and Designations of the Forest, Scenery.

SIO Range

SIO may exist, but will not be managed for

General Effects

Scenery is an integral part of all Forest settings and contributes to the quality of users' experience. The Chugach National Forest landscape is natural or natural appearing except for isolated alterations to the landscape character, primarily on the Kenai Peninsula. The most obvious and significant effects on scenic resources are from vegetation and landform alterations typically associated with resource management activities such as road construction, vegetation management, powerline clearing, recreation facility development, and mineral exploration and development. All projects proposed for implementation on the Forest will require a site-specific assessment of their potential impacts on scenic resources. The Scenic Integrity Objectives will serve as direction for design and implementation of management activities.

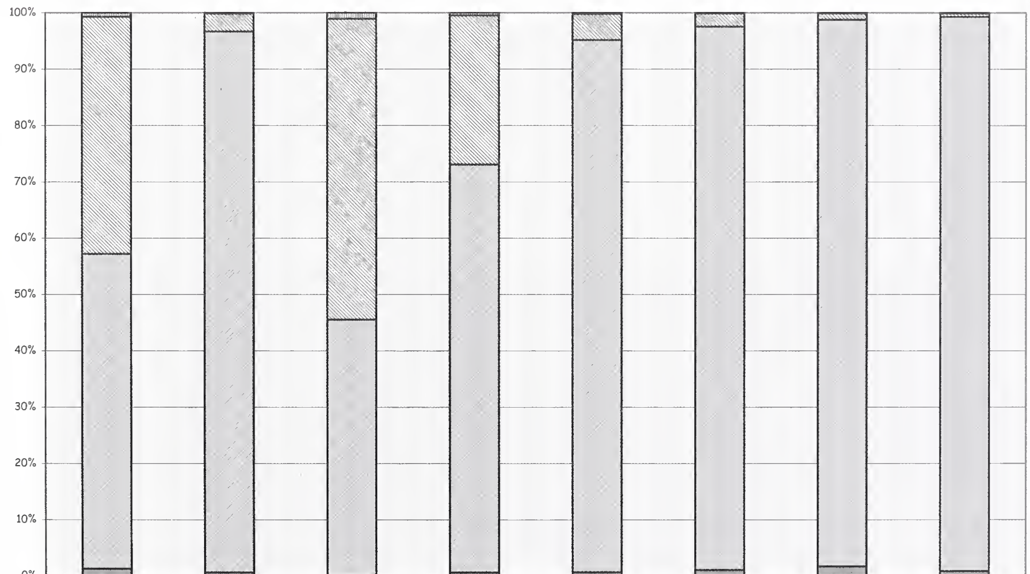
The Forest possesses areas of outstanding scenic beauty. These lands are valuable public assets that should be managed with care. The SIOs are directly related to the theme of the management area prescriptions. For each alternative, the Forestwide mix of SIOs varies with the mix of prescriptions applied to an alternative.

Each of these alternatives, if implemented, has the potential to maintain, alter or enhance the scenic character of the landscapes on the Forest to varying degrees. The Scenery Management System recognizes the interdependence of aesthetics and ecological systems, and promotes natural appearing landscapes. Across the alternatives, opportunities for viewing scenery would vary depending on a number of factors. Construction of roads, trails, and new recreation facilities would create opportunities for viewing scenery, while some viewing opportunities may be decreased by road closures. The SIOs for each alternative have been mapped.

In all alternatives, the overall landscape would maintain a natural appearing character. Even though Alternatives A, B and the No Action allow for higher levels of development and extraction of resources, noticeable changes in the scenery would be minimal.

Figure 3-72 displays the Scenic Integrity Objectives for each alternative. Maps, showing exactly where these acres are in any alternative, are available upon request.

Figure 3-72: Mapped scenic integrity objectives by alternative.



	NA	Preferred	A	B	C	D	E	F
VL	0	0	0	0	0	0	0	0
L	39370	8470	58770	27040	11420	7060	6850	6850
M	2308840	173870	2931070	1449860	254990	128690	60190	31860
H	3073960	5273760	2499190	3979200	5188120	5296320	5331800	5407870
VH	69410	35480	2550	35480	37050	59510	92740	45000

Under the No Action Alternative, management of the Forest would maintain its present course except for implementation of SMS, revision of the Allowable Sale Quantity (ASQ), and the use of updated inventories of other resources. This alternative has the potential to moderately alter scenic resources. Resource extraction or forest restoration activities, primarily vegetation management, may be noticed by visitors along the roads and trails of the Kenai Peninsula and portions of Prince William Sound, but should not detract from the overall enjoyment of viewing the scenery. The emphasis on recreation in this alternative increases the importance of high-quality scenery as a component of the recreation experience and setting.

The Preferred Alternative emphasizes natural processes across most of the Forest with restoration activities concentrated in several locations on the Kenai Peninsula. As scenery is one of the main reasons people come to the Forest, scenery is emphasized in this alternative. This alternative has the potential to slightly alter the scenic resource on the Kenai Peninsula with little change expected in Prince William Sound and the Copper River Delta. Scenic Integrity Objectives (SIOs) for selected locations on the Kenai Peninsula allow for a more noticeable change in the Landscape Character. For the rest of the Forest, SIOs maintain the existing Landscape Character.

Alternative A places the highest emphasis on resource production. This alternative would allow the most timber production along with production of other resources such as mineral development, and facilities to provide recreational experiences. This alternative has the greatest potential to alter scenic resources. Resource management activities along the roads and trails of the Kenai Peninsula, portions of Prince William Sound and road accessible areas of the Copper River Delta have lower SIOs, allowing for a more noticeable change in the Landscape Character. Some of these activities may be noticed by visitors along roads and trails, but should not detract from the overall enjoyment of viewing the scenery. This is consistent with the landscape character goals for this alternative.

Alternative B limits management activities to areas that have been previously managed. This would help minimize the impacts to forest scenery in areas that currently are natural appearing. This alternative has a low ASQ and a medium level of overall vegetation management. This alternative has the potential to develop the highest amount of new trails. This alternative has the potential to moderately alter scenic resources on the Kenai Peninsula and portions of the Copper River Delta. Little change is expected in Prince William Sound. Scenic Integrity Objectives allow for more change in the Landscape Character where more intense management is anticipated. This is consistent with the landscape character goals for this alternative.

Alternative C emphasizes wildlife habitat improvement, biological diversity and recreation. Developed recreation use would be concentrated. The emphasis on wildlife habitat improvement would contribute to a high amount of vegetation treatment. Impacts to scenic resources may result from these projects. This alternative has the potential to moderately alter scenic resources on the Kenai Peninsula, with little change expected in Prince William Sound and then Copper River Delta. Scenic Integrity Objectives are intended to maintain the Existing Landscape Character.

Alternatives D, E and F emphasize natural processes with development concentrated on existing access way. The recreation emphasis of these alternatives also emphasizes the importance of quality forest scenery in order to provide quality settings. These alternatives are expected to have little effect on scenic resources. Scenic Integrity Objectives are intended to maintain the existing Landscape Character.

For all alternatives, the SIO paralleling the Seward Highway Scenic Byway is High in the foreground, intended to maintain the existing Landscape Character.

Direct and Indirect Effects

Effects on Scenic Resources from Fire Management

In all alternatives wildland and prescribed fires have the potential to change the appearance of the landscape. Fire is a part of the natural process of the Kenai Peninsula but very rare in both Prince William Sound and the Copper River Delta. Prescribed fire on the Kenai Peninsula for fuels management does not vary by alternative. Standards and guidelines are in place to perform prescribed burns so that they appear natural (irregular shape, variable burn pattern). Visual changes may be noticed after a burn but would be come less noticeable, typically within 5 years, as new grasses, shrubs, and trees become established.

Effects on Scenic Resources from Insects and Diseases

Large insect infestations and diseases that kill forest trees have the potential to reduce scenic quality, especially if in pure stands. The spruce bark beetle infestation on the Kenai Peninsula has changed a portion of the viewed landscape. Because most of the Chugach is in mixed stands, the effect is not as great as other areas of the Kenai Peninsula where pure spruce stands have been affected. When infested areas are treated (timber harvest, prescribed fire), the scenic quality is reduced until new vegetation returns and attains a natural appearance. Standards and guidelines are in place to perform prescribed burns so that they appear natural (irregular shape, variable burn pattern). Visual changes may be noticed after a burn but would be come less noticeable, typically within 5 years, as new grasses, shrubs, and trees become

established. Alternatives A, B and No Action would introduce the most change in the scenery through management activities followed by the Preferred, C, D, E, and F.

Effects on Scenic Resources from Vegetation Management

The effects of vegetation management on scenery are addressed under fire, insect and disease, timber, and wildlife. Generally, manipulation of vegetation is the most noticeable change that can occur in the landscape. All the alternatives allow some vegetation management. Alternatives A, B and the No Action have the potential the change the scenery, especially on the Kenai Peninsula, the most.

Effects on Scenic Resources from Wildlife Management

Habitat improvement projects have the potential to change the viewed landscape. Prescribed burning and birch regeneration may affect scenic resources. The highest amount of prescribed burning occurs in Alternatives A, B, C, No Action and the Preferred. A moderate amount of prescribed burning occurs in Alternative D. The least amount of prescribed burning occurs in Alternatives E and F. All prescribed fire is planned for the Kenai Peninsula. Harvesting timber to increase forage for big game species has a potential to affect scenic resources. Standards and guidelines are in place to perform prescribed burns so that they appear natural (irregular shape, variable burn pattern). Visual changes may be noticed after a burn but would be come less noticeable, typically within 5 years, as new grasses, shrubs, and trees become established.

Effects on Scenic Resources from Fisheries Management

Water features such as falls, streams lakes, the ocean and wetlands are integral components of the scenery. Proposed fisheries habitat improvements do not vary significantly by alternative (Alternative E and F have less acres of lake and riparian improvement). Most projects are site specific and utilize native materials or techniques to minimize impacts to the scenery. By applying the principles of scenery management at the project level, fishery projects should have little effect on scenery.

Effects on Scenery from Recreation Management

Forestlands provide a spectrum of recreation opportunities for the public in both developed and dispersed settings. Scenic resources affect recreation resources and vice-versa. Most popular recreation sites are at or within view of outstanding scenery. Although convenience of access can influence where people go, so does scenery. People seek outstanding scenery for most of their recreation pursuits. All the alternatives maintain large areas of the Forest undeveloped, maintaining the existing scenic quality. In all alternatives, developed recreation facilities are most likely to be located near existing roads. Development of recreation opportunities can be a double-edged sword. On one hand, new opportunities can provide increased viewing opportunities, but these new opportunities can introduce elements not consistent with the landscape character, creating a negative effect. Alternative A and the No Action have the highest potential (although still relatively low) for the scenic quality to be reduced from recreation development. All the other alternatives may affect scenic quality along road corridors. In all alternatives, any development would apply the principles of scenery management to minimize any effect on scenic quality.

Effects on Scenic Resources from Access Management

Access management can open new areas, making more of the Chugach National Forest's outstanding landscape available and visible to more people. Over the last 20 years, few roads have been constructed and about 200 miles (including easements) of trail have been built. Of those, roads almost all have been within existing roaded corridors. While much of the scenery viewing on the Chugach is from roads, roads themselves can reduce scenic quality if poorly designed and located. New roads that are located and designed using the principles of scenery management will meet Scenic Integrity Objectives. None of the alternatives plan many new roads. Alternatives A, B and No Action have new roads for timber management and Alternative B includes new roads for access to new areas. Other roads proposed are associated with developed sites and are most likely to be within the existing road corridor.

Most forest scenery is viewed from roads. Tourism is a large part of the economic stability in many communities in and around the Forest, and the Chugach provides a large portion of the amenities for which visitors come to this area. The scenic quality would be maintained along all major travelways (roads and trails) on the Forest in all alternatives. All foreground areas along major travelways (roads and trails) are managed for High Scenic Integrity, as mapped.

New trails in all alternatives have the greatest potential to open more country to people, increasing the viewed landscape. Alternative C has the highest number of miles, followed by B, then D, the Preferred and A, E, No Action, and F. Trail construction is expected to have little effect on the scenic resources.

Effects on Scenic Resources from Minerals Management
Mineral and energy exploration and the potential development of these resources could affect scenic resources in any alternative. Alternatives with recommended Wilderness and Wild River designations would have the least effect on scenic resources. Alternative E, D and F recommend the largest amounts of Wilderness and Wild Rivers and would have the least effect on scenic resources, although, there is little difference among alternatives in the potential to affect scenery.

Effects on Scenic Resources from Timber Management
Newly created openings in existing stands of trees modify the landscape. There would be greater changes where landscapes currently have no visible changes. Alternatives A, B and No Action, anticipate scheduled harvest on about 6,170, 2,340, and 2,960 acres respectively. The existing Scenic Integrity Level for these areas is High. In each alternative, the Scenic Integrity Objective for these lands is Moderate, recognizing that harvest activities will be allowed to reduce the scenic integrity in planned harvest areas.

Timber management may be used as a tool to enhance scenery. Opportunities may be available to create scenic vistas and to do forest restoration. There may be opportunities to increase the types, ages, densities, and size classes of vegetation. The scenic quality would be maintained along all major travelways (roads and trails) on the Forest in all alternatives. All foreground areas along major travelways (roads and trails) are managed for High Scenic Integrity.

Cumulative Effects

Implementation of any of the alternatives is not likely to result in a significant change in the Forest landscape. The Revised Forest Plan will implement new Scenic Integrity Objectives consistent with the theme and emphasis of the alternatives.

The greatest cumulative change in the viewed landscape would most likely occur in Alternatives A, B and No Action. These alternatives have the largest acreage allocated to prescriptions allowing various vegetation treatments.

All alternatives emphasize maintaining a High Scenic Integrity Level along major travelways. Meeting the Scenic Integrity Objectives will help to maintain a key component of regional tourism.

Wild and Scenic Rivers

Introduction

The National Wild and Scenic River System is a system of free-flowing rivers designated by Congress. Wild and Scenic Rivers offer outstanding natural, heritage, or recreational features that are protected for future generations. During forest planning, the Forest Service evaluates rivers that cross National Forest System lands and recommends rivers suitable for inclusion in the National Wild and Scenic Rivers System. Wild and Scenic Rivers are managed to protect their free-flowing characteristics and their particular outstandingly remarkable values.

For a river to be included in the Wild and Scenic Rivers System, it must meet the tests of eligibility and suitability. To be eligible, a river must be free flowing and possess river or river-related values that are judged to be outstandingly remarkable. To be suitable, the benefits of designation should outweigh the disadvantages. It involves considering the land ownership in the area; the land uses that would be affected; public, state, and local government interest in the river's designation; estimated costs; and any other issues raised during the planning process.

Legal and Administrative Framework

- The **Wild and Scenic Rivers of 1968** as set forth herein consists of Public Law 90-542 (October 2, 1968) and amendments there to, establishes the National Wild and Scenic River System, designates the rivers included in the System, establishes policy for managing designated rivers, and prescribes a process for designating additions to the system. The Wild and Scenic Rivers Act also establishes that it is national policy to "preserve... selected rivers or sections thereof in their free-flowing condition to protect water quality of such rivers and to fulfill other vital national conservation purposes." The Act also states that these rivers "shall be preserved in a free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations."

  The Act recognizes three classifications of protected rivers: (1) wild rivers are "essentially primitive and ...unpolluted [representing] vestiges of primitive America," (2) scenic rivers are "largely undeveloped, but accessible in places by roads," and (3) recreational rivers are "readily accessible" and "may have some development" including impoundments or diversions.

- **Forest Service Handbook 1909.12.** Chapter 8 directs the Forest Service to evaluate rivers for inclusion in the National Wild and Scenic River System during planning pursuant to section 5(a) of the Act.

Key Indicators

- Number and miles of rivers recommended for Wild and Scenic designation

Resource Protection Measures

To the extent of Forest Service authority, the following resource protection measures will be applied to the rivers recommended to the National System through this planning effort.

Eligible Wild Rivers:

- **Vegetation** – cutting of trees will not be permitted unless the purpose is to protect or enhance the river's outstandingly remarkable resource values.
- **Water Supply/Flood Control** – All hydroelectric power facilities and major water supply dams or diversions are prohibited.
- **Mining** – New mining claims, mineral leases and mineral material sales are prohibited within the river corridor. Valid claims would not be abrogated. Existing mineral activity must be conducted to minimize surface disturbance, sedimentation, and visual quality. Reasonable access is allowed.
- **Access and Transportation** – New roads are not allowed. Motorized travel on land or water could be permitted, but is generally not compatible with this management area direction. The level of motorized use shall not exceed the level present at the time of designation of the river.
- **Recreation Development** – Major public-use sites (campgrounds, administrative buildings) are located outside the Wild River corridor. Facilities or signs, essential for site protection, may be constructed but must be rustic in design to blend in with the natural character of the area.
- **Utilities** – New transmission lines, gas lines, water lines, communication sites, utility corridors, etc., are discouraged. Where no reasonable alternative exists, additional or new facilities should be restricted to existing rights-of-way. Where new rights-of-way are indicated the scenic, recreational, and fish and wildlife values must be evaluated in the selection of the site.

Eligible Scenic Rivers:

- **Vegetation** – A wide range of silvicultural practices could be allowed, provided that such practices are carried on in such a way that there is no substantial adverse effect on the river and its immediate environment. The river should be maintained in its near natural condition including the long-term scenic character of the river environment.

- **Water Supply/Flood Control** – All hydroelectric power facilities and major water supply dams or diversions are prohibited.
- **Mining** – New mining claims, mineral leases and mineral materials sales that could be allowed are conducted in a manner that minimizes sedimentation and visual impairment. Mining activity must be conducted in a manner that minimizes effects on the outstandingly remarkable values of the river. Existing operations are allowed to continue.
- **Access and Transportation** – New roads could be allowed but should be inconspicuous. Roads may occasionally bridge the river area and short stretches may be conspicuous. Generally, winter motorized recreation use would be allowed. Summer motorized travel on land or water could be permitted, but should the level should be considerate of potential impacts on river values, user demand for such motorized recreation, health and safety to users, and compatibility with the expected recreation experience for a scenic river.
- **Recreation Development** – Modest and unobtrusive cabins and minor lodges could be allowed if they are screened from the river. Structures should be compatible with the river's classification, allow the area to remain natural in appearance, and harmonize with the surrounding environment.
- **Utilities** – New transmission lines, gas lines, water lines, communication sites, utility corridors, etc. are discouraged. Where no reasonable alternative exists, additional or new facilities should be restricted to existing rights-of-way. Where new rights-of-way are indicated the scenic, recreational, and fish and wildlife values must be evaluated in the selection of the site.

Eligible Recreational Rivers:

- **Vegetation** – vegetation may be modified for habitat improvement projects or recreation sites. Openings in forest cover may be present, but should not dominate the landscape. Commercial timber harvest could not be scheduled during the planning period because the potential affect on the outstandingly remarkable values of the river could not be predicted.
- **Water Supply/Flood Control** – All hydroelectric power facilities and major water supply dams or diversions are prohibited.
- **Mining** – New mining claims, mineral leases and mineral materials sales are allowed and existing operations are allowed to continue. Mineral activity must be conducted in a manner that minimizes surface disturbance, sedimentation, pollution, and scenic quality.

- **Access and Transportation** – New roads may be constructed. Motorized travel on land or water may be permitted, prohibited or restricted. Controls will usually be similar to surrounding lands and waters. Generally, winter motorized recreation use will be allowed. Summer motorized recreation can be allowed but will be confined to designated routes or areas. If such use adversely impacts a river's outstandingly remarkable value, then the route or area could be closed or regulated.
- **Recreation Development** – Both minor and major recreation-related facilities may be permitted, if determined to be consistent with the overall intent of the area.
- **Utilities** – New transmission lines, gas lines, water lines, communication sites, utility corridors, etc., are discouraged. Where no reasonable alternative exists, additional or new facilities should be restricted to existing rights-of-way. Where new rights-of-way are indicated the scenic, recreational, and fish and wildlife values must be evaluated in the selection of the site.

Affected Environment

In 1972 the Bureau of Outdoor Recreation established a task force to evaluate free-flowing rivers in Alaska that might qualify for inclusion in the National Wild and Scenic Rivers System. Their statewide preliminary screening of all rivers identified 69 rivers for consideration. Of these 69 rivers, portions of the Copper, Kenai and Russian flow through the Chugach National Forest. Today, 33 Alaska rivers are included in the Wild and Scenic Rivers system. None of the rivers flow through the Chugach National Forest.

All named rivers and glaciers (760+) and many unnamed rivers on the Chugach National Forest were examined and evaluated to identify "outstandingly remarkable" river-related features which would make them "eligible" for inclusion in the National Wild and Scenic Rivers System.

Each stream found eligible for inclusion in the system will be managed to maintain its eligibility until a suitability study is completed. Individual suitability studies will be completed when the Record of Decision is signed.

For each stream found eligible, classification (wild, scenic, or recreational) was made based on the following:

- **Wild** - Rivers or sections of rivers that are free of impoundments, with watersheds or shorelines essentially primitive; generally inaccessible except by trail, with undisturbed landscapes.
- **Scenic** - Rivers or sections or river that are free of impoundments with watersheds or shorelines still largely primitive and undeveloped; can be accessible in places by inconspicuous, well-screened local roads.

- **Recreational** - Rivers or sections of river that are readily accessible by road or railroads and have some degree of development along their shoreline where minor structures are allowed, provided the waterway generally remains natural in appearance.

Table 3-73a displays the results of the inventory and evaluation of streams on the Forest for eligibility.

Table 3-73a: Streams eligible for inclusion in the National Wild and Scenic River System.

River Name	Outstandingly Remarkable Value(s)	Wild	Scenic	Recreational
Bear Creek	Geologic feature	0	0	3.4
Sixmile Creek	Recreational whitewater boating, scenery & visual features	0	5.7	0
East Fork Sixmile Creek	Recreational whitewater boating, scenery & visual features	0	5.6	0
Canyon Creek	Geologic feature	0	6.8	0
Snow River	Scenery & visual features	23.8	0	0
Twentymile River (complex)	Synergistic effects of combined special resource values	14.2	0	0
Palmer Creek	Scenery & visual features	0	10.9	0
Portage Lake & Glacier	Scenery & visual features, recreational values	4.7	2.3	0
Portage Creek	Scenery & visual features	0	0	6.2
Kenai River	Fisheries value	0	0	5.5
Russian River	Fisheries & prehistoric values	14.3	3.0	0
Columbia Glacier	Geologic feature	19	0	0
Coghill River	Fisheries, recreational values, scenery & visual features	11.5	0	0
Cascade Creek	Visual feature (waterfall)	2	0	0
Nellie Juan River	Recreational whitewater boating, scenery & visual features	25.1	0	0
Martin Glacier	Geologic feature	18	0	0
Martin River & Lake	Scenery & visual features, geologic feature, fisheries, recreational values	24.5	1.8	0
Alaganic Slough & unnamed tributary	Historic/cultural values	0	13	0
Copper River - lower (delta complex)	Scenery & visual features, historic and cultural values, fisheries and wildlife values, geologic feature	24.3	1	0
Copper River –upper	Scenery & visual features, recreational values, fisheries values	51.3	0	0
Bering River & Lake	Scenery & visual features, recreational values, fisheries values	6.6	25.2	0
Katalla River	Fisheries values	4.8	7.1	0
Nellie Martin River	Fisheries value	0.4	1.6	0
Number 1 River	Recreational whitewater boating & geologic values.	6.7	0	0
Total river miles by potential classification		**251.2**	**84**	**15.1**
Total miles of eligible river segments			**350.3**	

Environmental Consequences

General Effects

Appendix D contains the suitability reports for each of the 23 eligible rivers. They describe in detail the anticipated effects of designation and non-designation with respect to the six suitability factors referred to in Section 4 of the Wild and Scenic Rivers Act. One of the factors in the suitability reports is consideration of a range of alternatives for managing the river, whether recommended for designation or not. The 23 rivers, with numerous segments, and three possible classifications, present hundreds of possibilities for structuring alternatives at the Forest Plan level. In some cases, a stream is shown with a Wild classification in one alternative, and a different classification in another, and may not be included (or

reflects fewer miles) in another alternative. Assigning a river to a given alternative was a reflection of the alternative theme and evaluation of suitability factors, recognizing other possible combinations for a particular river might exist.

The Preferred Alternative recommends designation of Sixmile Creek, East Fork Sixmile Creek, Snow River, Portage Creek, Twentymile Creek, Nellie Juan River and Russian River, for a total of 82.4 miles.

Under the No Action Alternative and Alternative A, there would be no recommendation for wild and scenic river designations.

Alternative B recommends designation of the East Fork Sixmile Creek, Sixmile Creek and Snow Rivers, for a total of 35.1 miles.

Alternative C recommends designation of the Cascade Creek, Columbia Glacier, East Fork Sixmile Creek, Nellie Juan River, Palmer Creek, Sixmile Creek and Snow River, for a total of 92.1 miles.

Alternative D recommends designation of the Cascade Creek, Columbia Glacier, East Fork Sixmile Creek, Martin River, Martin Glacier, Nellie Juan River, Palmer Creek, Sixmile Creek and Snow River, for a total of 136.4 miles.

Alternative E recommends designation of the Alaganic Slough, Bering River, Canyon Creek, Cascade Creek, Coghill River, Copper River, East Fork Sixmile Creek, Katalla River, Martin River, Martin Glacier, Nellie Juan River, Nellie Martin River, Palmer Creek, Portage Creek, Portage Lake and Glacier, Russian River, Sixmile Creek, Snow River and Twentymile River, for a total of 315.7 miles.

Alternative F recommends designation of all 350.3 miles of eligible rivers. The complete list of eligible rivers includes Alaganic Slough, Bear Creek, Bering River, Canyon Creek, Cascade Creek, Coghill River, Columbia Glacier, Copper River, East Fork Sixmile Creek, Katalla River, Kenai River, Martin River, Martin Glacier, Nellie Juan River, Nellie Martin River, Number 1 River, Palmer Creek, Portage Creek, Portage Lake and Glacier, Russian River, Sixmile Creek, Snow River and Twentymile River.

Tables 3-73b and 3-73c show the Wild and Scenic River miles by alternative and classification.

Table 3-73b: Wild and Scenic River miles by alternative and classification.

River	Miles	NA	Preferred	A	B	C	D	E	F
						Alternative			
Bear Creek	3.4								3.4 (R)
Sixmile Creek	5.7		5.7 (R)		5.7 (R)	5.7 (S)	5.7 (S)	5.7 (S)	5.7 (S)
East Fork Sixmile Creek	5.6		5.6 (R)		5.6 (R)	5.6 (R)	5.6 (S)	5.6 (S)	5.6 (S)
Canyon Creek	6.8							6.8 (S)	6.8 (S)
Snow River	23.8		5.1 (S)		23.8 (R)	23.8 (S)	23.8 (W)	23.8 (W)	23.8 (W)
Snow River			18.7 (W)						
Twentymile River	14.2		14.2 (S)					14.2 (W)	14.2 (W)
Palmer Creek	10.9					10.9 (R)	10.9 (S)	10.9 (S)	10.9 (S)
Portage Lake	2.3							1.5 (S)	1.5 (S)
Portage Lake								0.8 (W)	0.8 (W)
Portage Glacier	4.7							4.7 (W)	4.7 (W)
Portage Creek	6.2		6.2 (R)					6.2 (R)	6.2 (R)
Kenai River	5.5								5.5 (R)
Russian River	17.3		12.4 (W)					14.3 (W)	14.3 (W)
Russian River			4.9 (R)					3.0 (S)	3.0 (S)
Columbia Glacier	19.0					19.0 (S)	19.0 (S)		19.0 (W)
Coghill River	11.5							11.5 (W)	11.5 (W)
Cascade Creek	2.0					2.0 (W)	2.0 (W)	2.0 (W)	2.0 (W)
Nellie Juan River	25.1		9.6 (W)			25.1 (S)	25.1 (S)	25.1 (W)	25.1 (W)
Martin Glacier	18.0						18.0 (W)	18.0 (W)	18.0 (W)
Martin River and Lake	24.5						24.5 (W)	24.5 (W)	24.5 (W)
Martin River and Lake	1.8						1.8 (S)	1.8 (S)	1.8 (S)
Alaganic Slough	13.0							13.0 (S)	13.0 (S)
Copper River Lower	25.3							24.3 (W)	24.3 (W)
Copper River Lower								1.0 (S)	1.0 (S)
Copper River Upper	51.3							51.3 (W)	51.3 (W)
Bering River and Lake	31.8							6.6 (W)	6.6 (W)
Bering River and Lake								25.2 (S)	25.2 (S)
Katalla River	4.8							4.8 (W)	4.8 (W)
Katalla River	7.1							7.1 (S)	7.1 (S)
Nellie Martin River	0.4							0.4 (S)	0.4 (S)
Nellie Martin River	1.6							1.6 (W)	1.6 (W)
Number 1 River	6.7								6.7 (W)
Total	**350.3**	**0.0**	**82.4**		**35.1**	**92.1**	**136.4**	**315.7**	**350.3**

Table 3-73c: Wild and Scenic River miles by river by alternative and classification.

River	Miles	NA	Preferred	A	B	C	D	E	F
						Alternative			
Recreational	15.9	0	22.4	0	35.1	16.5	0	7.0	15.9
Scenic	57.0	0	19.3	0	11.3	73.6	68.1	83.8	99.2
Wild	277.4	0	40.7	0	23.8	2.0	68.3	224.9	235.2
Total	**350.3**	**0**	**82.4**	**0**	**35.1**	**92.1**	**136.4**	**315.7**	**350.3**

Direct and Indirect Effects

The types and amounts of activities and changes acceptable within a river corridor depend on whether it is recommended as a Wild, Scenic or Recreational River. Because Forest Plan alternatives effects are not site specific, it is not possible to describe precisely how an individual stream may be affected by future projects, since the exact locations and designs of those projects are not yet determined. It is possible, however, to describe and to display the general

effects of various management activities on the eligibility and potential classification of rivers. These potential effects are described below.

In Appendix D, the effects of alternatives on each eligible river are described in more detail through the individual river suitability studies. Specific kinds of Forest activities and uses can affect the classification or eligibility of rivers. These are described in the next few paragraphs:

- **Timber Harvesting** - Timber harvesting and associated roads and log transfer facilities can have a major effect on the potential for a river to be considered eligible, and, if eligible, which classification it meets. Extensive, highly visible, and ongoing timber harvesting within a river corridor could result in the river becoming ineligible for any classification. Where timber harvest maintains the natural appearance of the river corridor as seen from the river and its banks, the river may qualify for Scenic classification; more alteration may still be acceptable for a Recreational classification. Vegetation management practices must maintain free-flow and the outstandingly remarkable values of the river.

- **Water Project Development** - Any major impoundment for water storage or hydroelectric power would cause a river segment to be ineligible. In the case of hydroelectric proposals that meet the criteria for licensing by the Federal Energy Regulatory Commission (FERC), the Forest Service is not the permitting agency, and serves only in an advisory role to FERC. Depending on their visibility and extent, low dams and diversions, penstocks, transmission lines and other facilities may affect the classification of the river. Where these facilities are visually subordinate, the river may be classified as a Recreational River. Where such features dominate the landscape, the river is likely to be ineligible.

- **Minerals** - Large-scale mining activity could result in an eligible river becoming ineligible, or result in its being eligible only in the Recreational classification. Some types of mineral exploration may not affect the classification of a river as Scenic or Recreational, as long as the outstandingly remarkable values and classification objectives are maintained. The No-Surface Occupancy stipulation would protect Scenic and Recreation Rivers while at the same time allow oil and gas leasing and extraction by directional drilling. Wild Rivers are withdrawn from mineral entry.

- **Recreation Development -** Development of trails, hike-in (or fly-in or boat-in) cabins, and campsites would not likely affect the Wild classification of a river, nor would continuation of traditional access by motorized equipment. In addition to the above, developments such as launch sites and modest recreation sites would not affect the Scenic classification, as long as the development did not greatly alter the natural character. Development of major

recreation sites, boat launches, other visitor facilities, would generally cause a river to meet only the Recreational classification.

- **Roads** - Any construction of roads in the river corridor would eliminate that segment of river from classification as a Wild River. Even roads outside of the river corridor might be incompatible with Wild classification, if they detracted from the primitive character or an outstandingly remarkable value, especially scenic values. Construction of roads and bridges that occasionally cross or reach the river would not affect the classification of a Scenic River, assuming such roads are infrequent and relatively inconspicuous. In broad valley settings, a major road might be compatible with the Scenic classification due to the scale of the landscape. Construction of a major highway or extensive road system could limit a river to the Recreational classification.
- **Fish Improvement Projects** - Constructed fish passes and other structures associated with improvement of fish habitat are possible in all classifications, if determined on a case-by-case basis that the facility does not alter the free-flowing character of the river or conflict with the outstandingly remarkable values. Developments in the Wild classification would need to be compatible with the primitive character of the river area. Some fish improvements typical in Alaska may not be allowed or may be more expensive to build on a Wild River. Construction of an on-stream fish hatchery would be compatible only with the Recreational classification.
- **Wildlife Habitat Improvements** - Manipulation of vegetation or improvements such as fencing or artificial nest structures, would likely be incompatible with Wild classification. They might be compatible with a Scenic designation, as long as the undeveloped character was maintained. Most improvements would be acceptable in a Recreational classification, consistent with the outstandingly remarkable values.

Conversely, designation of a river as a component of the National Wild and Scenic Rivers System can affect the management of various resources. Generally, the corridor width for designated rivers is one-quarter of a mile on each side of the river. Final boundaries can and do vary from this minimum, but generally follow the ¼ mile guideline. Congressional designation as a Wild, Scenic or Recreational River in Alaska might result in the establishment of a Conservation System Unit as defined by ANILCA. Where rivers are designated in Wilderness, the most restrictive provisions of the two laws would apply.

Congressional designation as a Wild River results in the area being withdrawn from mineral entry. Scheduled commercial timber harvest is not allowed, and outputs of timber from tentatively suitable forestlands are foregone. Construction of major recreation facilities, roads, power lines and other features are not allowed. However, if designated as a Conservation System Unit under ANILCA,

Title XI defines a process whereby transportation and utility corridors may be allowed. The potential for hydroelectric power generation is also foregone. Within Wilderness, the President of the United States may authorize water resource projects but no such provision exists in the Wild and Scenic Rivers Act. Designation under the Wild and Scenic Rivers Act would provide an added degree of protection, requiring congressional approval. Some opportunities for fish and wildlife habitat enhancement would also likely be foregone if they would impede or divert water flow or otherwise adversely affect the outstandingly remarkable characteristics of the river. Congressional designation would not affect the rights of landowners within a Wild River area, except perhaps access constraints. Other restrictions could result from enabling legislation if zoning or other regulatory changes were enacted by local governments through their public processes. Designation, particularly where tributary streams, important visual features, or outstandingly remarkable values lie outside the ¼ mile corridor, could affect the management of lands adjacent to a Wild River by requiring more constraints or complimentary Land Use Designations. The Wild and Scenic Rivers Act also requires that upstream water projects may not unreasonably diminish the scenic, recreational, fish or wildlife values within the designated river nor can a downstream project back water into the designated segment.

Congressional designation as a Scenic River places significant constraints on the management of timber in the river corridor, although timber harvest generally out of view of the river or recreation sites could occur. The area is not withdrawn from mineral entry, but costs of mining could increase as a result of standards to maintain identified values and Scenic River objectives. The potential for hydroelectric power generation is foregone. Construction of major recreation facilities could be limited. Roads, while allowed, could be more expensive as design seeks to minimize the visual impact and the number of bridge crossings. Effects on management of adjacent lands would be less than for a Wild River, although activities affecting sensitive visual features may be constrained resulting in increased cost or reduced output.

Congressional designation as a Recreational River places fewer constraints on management and development activities, although the potential for new diversions and hydroelectric power generation is foregone. Timber may be harvested, although visual constraints may increase the cost of timber harvest and reduce outputs.

Congressional designation of a system of Wild and Scenic Rivers has many positive effects. The undeveloped nature of the region presents a unique opportunity to identify the very best candidates for addition to the system. The opportunity presents itself to represent a wide range of outstanding values for a variety of geological and ecological settings, on a large geographic scale. A system of rivers would complement the conservation units already designated by Congress in Southeast Alaska, and could recognize the unique social, economic, and development needs through the enabling legislation, as was done in ANILCA.

A system of Wild and Scenic Rivers could open up new tourism marketing opportunities, as is often the result of the attention focused on congressionally designated areas. On a regional scale, this could be used as a tool to capture a larger segment of visitors to further stimulate tourism and the economies of the area. On a local scale, certain communities or service providers could promote different areas and activities, and attract specific market segments of users. Opportunities could vary from primitive experiences to those in more developed settings, and encompass a variety of activities. Promotion of a designated river might be the vehicle for a successful operation. The down side of this marketing opportunity might be attracting too many people (in some people's opinion), resulting in user conflicts such as for subsistence use, and more regimented managerial controls.

Cumulative Effects

Currently, Alaska has 33 designated Wild and Scenic Rivers totaling 3,284 miles. This represents nearly 1/3 of the total number of river miles in the National System. If any of the 23 eligible rivers on the Chugach National Forest (350.3 miles) were designated some increases in recreation use and tourism could be expected to occur. However, taken in a regional context, changes in recreation use, tourism and local income would probably not be measurable.

Effects of non-designation would likewise have little regional significance on recreation use or tourism. Non-designation might, however, represent a lost opportunity to protect river characteristics that are unusual in the region.

Non-designation would allow consideration of full range of alternatives for various resource activities. These include fish improvement projects, recreation site development, transportation and utility corridors, mineral exploration and development, and timber harvest, consistent with the management area prescription they fall within. This could result in increased resource outputs, cost savings, and fewer resource impacts as a result of having more options. Eligible rivers that are allocated to the Category 1 or 2 management area prescriptions are likely to retain their eligibility and potential classification. However, unless they are in Wilderness, the river corridors remain open to mineral entry and the development of water resources. In addition, some of the Category 2 prescriptions allow or conditionally allow consideration for development of transportation and utility corridors. Since proposals for these activities cannot be predicted with any degree of accuracy, their potential effect on the eligible rivers was not analyzed. Appendix D does identify where these potential developments are more likely to occur.

- **Rivers Recommended for addition to the National System**

  Rivers that are recommended for designation would be managed according to the Wild and Scenic River Management Area prescriptions at the recommended classification. These prescriptions, along with the Forestwide standards and guidelines, would ensure that the free-flow, water quality and the outstandingly remarkable values remain. Key standards and

guidelines include those for Soil, Water, Fish, Scenery, and Recreation and Tourism.

The Preferred Alternative recommends designation of East Fork Sixmile Creek, Sixmile Creek, Snow River, Portage Creek, Twentymile Creek, Nellie Juan River, and Russian River, for a total of 82.4 miles. These rivers would be recommended to the Chief of the Forest Service by the Regional Forester as part of the approval of the Revised Forest Plan.

This would be a preliminary administrative recommendation that will receive further review and possible modification by the Chief of the Forest Service, Secretary of Agriculture, and the President of the United States. Congress has reserved the authority to make final decisions on designation of rivers as part o the National Wild and Scenic Rivers System.

The rivers recommended in the Revised Forest Plan would be managed to retain their free-flowing character and outstandingly remarkable values at their recommended level of classification, within the existing authorities of the Forest Service. The final outcome for designation of these rivers rests with Congress.

- **Rivers not recommended and within a management area prescription that will generally protect the river's free-flow, water quality and outstandingly remarkable values.**

  The Preferred Alternative does not recommend designation of Canyon Creek, Palmer Creek, Portage Glacier and Lake, Kenai River, Columbia Glacier, Coghill River, Cascade Creek, martin Glacier, Martin River and Lake, Alaganic Slough, Copper River, Bering River and Lake, Katalla River, Nellie Martin River and Number 1 River. These rivers are located within Category 1 and 2 management area prescriptions including Backcountry, Fish and Wildlife Conservation, Recommended Wilderness, Wilderness Study Area, 501(b) - 2 and 501(b) - 1. Although hydroelectric power facilities and major water supply dams, fish projects or diversions are not prohibited they are generally not compatible with the themes and management intent of Category 1 and 2 management area prescriptions.

- **Rivers not recommended and within a management area prescription that is likely incompatible with protecting a river's free-flow, water quality and outstandingly remarkable values.**

  Bear Creek is located within the Recreation, Fish and Wildlife Management Area prescription that allows a variety of multiple-use activities. The outstandingly remarkable value of the river is the discovery of the largest gold nugget in the State of Alaska. This

particular nugget is no longer in the river and the Recreation, Fish and Wildlife Management Area prescription does not withdraw the area from mineral entry. Thus, if additional large gold nuggets remain in the River they would not be protected from removal. The level of mining activity that occurs on Bear Creek will not ensure protection of water quality and free-flow.

Wilderness

Introduction

The Wilderness Act of 1964 established the National Wilderness Preservation System. It mandates that Wilderness areas be "…. administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness." Currently, there is no designated Wilderness on the Chugach National Forest.

The Forest Service is required to inventory, evaluate, and consider all roadless areas for possible inclusion in the National Wilderness Preservation System (see "Roadless," this Chapter). In 1978, the Chugach Forest completed an inventory of unroaded areas as part of the national process called RARE II. At that time the Administration's proposal was to designate 669,500 acres on the Chugach National Forest as Wilderness. Three additional areas were recommended for Wilderness in the RARE II process. These three areas, the Two Indians drainage west of Resurrection Creek, and the Tonki Cape and Devil Paw area on Afognak Island are no longer part of the Chugach National Forest. Two areas, the Resurrection Roadless Area, and the southern portion of the Eastern Kenai Mountains Roadless Area around Snow River, were designated as non-Wilderness roadless. All other areas on the Forest evaluated for roadless characteristics (3,301,800 acres) were put into a further planning category to be evaluated during Forest Planning (see Current Management in this section).

In 1980, the Alaska National Interest Lands Conservation Act (ANILCA) added 2,156,000 roadless acres to the Forest. ANILCA did not establish any Wilderness on the Chugach National Forest. However, Section 704 identified the Nellie Juan-College Fiord area and required the Forest Service to study the area and make a Wilderness recommendation. Because of the unique situations and established uses in Alaska, ANILCA also provided a number of important exceptions to the management of designated Wilderness in Alaska, such as traditional motorized use.

Legal and Administrative Framework

- The **Wilderness Act of 1964** – establishes the framework for wilderness management and for designating additional Wilderness.
- **Alaska National Interest Lands Conservation Act (ANILCA) of 1980 -** provides for motorized access and mechanized equipment related to traditional activities, subsistence activities, equipment use related to the taking of fish and wildlife, administrative needs, and activities in Alaska wilderness. It also established the Nellie Juan-College Fiord Wilderness Study Area.

- **Planning Regulations (36 CFR 219.17)** state: "Unless otherwise provided by law, roadless areas within National Forest System shall be evaluated and considered for recommendation as potential Wilderness areas during the Forest Planning process."

Key Indicators

- Acres recommended for Wilderness designation

Resource Protection Measures

Areas recommended for Wilderness designation in the Record of Decision (ROD) and the Nellie Juan-College Fiord Wilderness Study Area will be managed to maintain their existing wilderness character and potential for inclusion in the National Wilderness Preservation System until congressional action on the recommendations and the Wilderness Study Area. Any recommendation for Wilderness designation is a preliminary administrative recommendation that will receive further review and possible modification by the Chief of the Forest Service, the Secretary of Agriculture, and the President of the United States (FSM 1923.11). The Congress has reserved the authority to make final decisions on Wilderness designation.

Affected Environment

Inventory and Evaluation Process

In order for a parcel of land to qualify for evaluation as a potential addition to the National Wilderness Preservation System, it must meet the minimum standards set by Congress in the Wilderness Act of 1964. These standards require an area to generally appear to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; to have outstanding opportunities for solitude or a primitive and unconfined type of recreation; to have at least 5,000 acres of land or in sufficient size as to make practicable its preservation and use in an unimpaired condition; and may also contain ecological, geological or other features of scientific, educational, scenic or historic value. An area is recommended as suitable for Wilderness if it met the test of capability, availability, and need.

The 1996 roadless inventory conducted by the Forest identified 16 roadless areas that fairly closely follow the roadless divisions used in RARE II. Areas within ¼ mile of improved roads, including the state highways, Palmer Creek Road, Snug Harbor Road, Montague Island Road, Copper River Highway, or other roads maintained for travel by standard passenger type vehicles were excluded from roadless evaluation. Also excluded were small "donuts" created by roads surrounding or almost completely surrounding small parcels of land. Private land and state land within the roadless area boundary was not evaluated. Lands selected but not yet conveyed to either the state or Native corporation were included in the evaluation. Roadless areas on the Chugach were mapped

using the criteria listed in the Forest Service Handbook 1909.12 and acreages were updated on February 14, 2000, using the Forest's GIS corporate database.

Individual reports on each roadless area have been prepared (FEIS, Appendix C). Major topics in the reports include the area's relationship to other planning efforts; a description of the ecosystems involved; history, soils, fish, wildlife, and recreation resource uses and patterns; current use and management; appearance, external influences, natural integrity, opportunity for solitude, special features, resource potentials and relationship to communities and other roadless and wilderness areas (36 CFR 219.12(f)(1)). The reports also show how the roadless areas would be managed under each alternative.

In accordance with the CNI Settlement Agreement, Chugach Alaska Corporation has been granted an easement to construct a road from the Copper River Highway to their lands near Carbon Mountain. The 30-mile road would cross through the Bering Lake Roadless Area. The CNI Settlement Agreement also provided for an access route from their lands toward a marine terminal (Katalla route). The easement areas (1/4 mile on either side of the roads) were not included in the Bering Lake Roadless Area acreage.

The Montague Island Roadless Area had a 37-mile special use road that was not open to the public. The road has been closed and obliterated, and the area is now included as part of the roadless area.

Currently about 99 percent of the Forest or 5,434,710 acres out of 5,491,580 total acres are inventoried as roadless and meet the requirements for evaluation as wilderness. Except for the areas identified as guaranteed access into the Bering River Coalfields under valid existing rights, all areas inventoried as roadless in the current inventory are available for Wilderness designation or continued management for their roadless character. Table 3-74 displays the 16 roadless areas, their acreage and any special designations applicable to the area. The roadless areas are displayed in Figure 3-73.

Current Management

Consistent with congressional intent for the 2,115,000-acre Nellie Juan-College Fiord Wilderness Study Area (WSA) 1984 Forest Plan direction is to manage the area to maintain its presently existing wilderness character (1980) and potential for inclusion in the National Wilderness Preservation System. Because of the conveyance of some lands in the WSA to the State of Alaska and Alaska Native corporations, only 1,746,970 acres are currently available for Wilderness recommendation or designation.

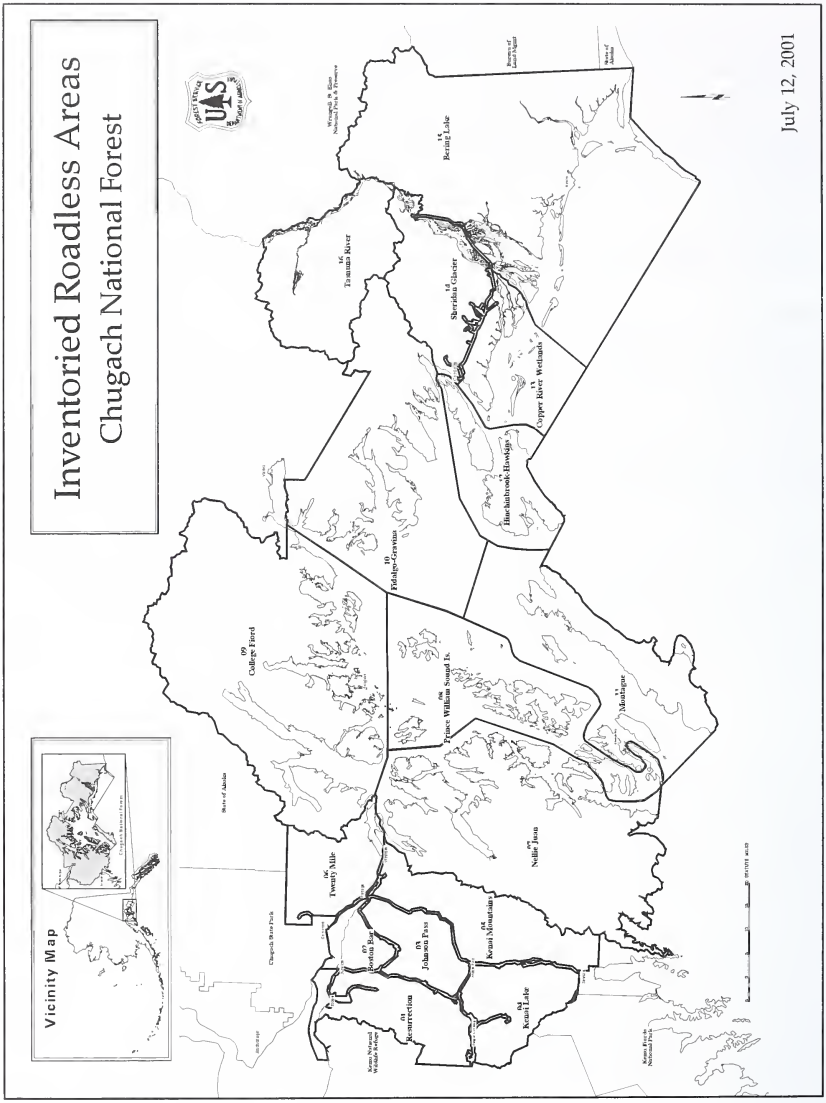
The 1984 Forest Plan direction recommended 1,655,000 acres of the Study Area for Wilderness designation. The 1984 Forest Plan also recommended about 48,000 acres of roadless lands outside the WSA for Wilderness designation. Current direction is to manage these lands to maintain their presently existing wilderness character (1980) and potential for inclusion in the National Wilderness Preservation System.

Table 3-74: Chugach National Forest roadless areas.

Roadless Area	Roadless Acreage	Special Designation or 1984 Forest Plan Recommendation
01 Resurrection	224,460	Designated non-Wilderness roadless in RARE II, not evaluated for Wilderness in 1984 Forest Plan.
02 Boston Bar	53,590	No special designation.
03 Johnson Pass	153,020	No special designation.
04 Kenai Lake	212,960	No special designation.
05 Kenai Mountains	306,580	48,220 acres recommended for Wilderness designation (Forest Plan).
06 Twentymile	198,560	No special designation.
07 Nellie Juan	734,100	Wilderness Study Area (ANILCA).
08 Prince William Sound Islands	119,520	Wilderness Study Area (ANILCA).
09 College Fiord	1,129,610	Wilderness Study Area (ANILCA)
10 Fidalgo-Gravina	316,330	17,800 acres managed with primary purpose conservation of fish and wildlife and their habitat.
11 Montague Island	205,270	No special designation.
12 Hinchinbrook- Hawkins Islands	144,470	No special designation.
13 Copper River Wetlands	88,650	73,600 acres managed with primary purpose conservation of fish and wildlife and their habitat.
14 Sheridan Glacier	231,810	153,500 acres managed with primary purpose conservation of fish and wildlife and their habitat.
15 Bering Lake	966,240	964,940 acres managed with primary purpose conservation of fish and wildlife and their habitat. Two rights-of-way to access private land under CNI agreement.
16 Tasnuna River	349,540	Managed with primary purpose conservation of fish and wildlife and their habitat.
Total	**5,434,710**[1]	

[1] Note: This is a –4,290 acres (0.08 percent) difference in the Forest Service Roadless Conservation FEIS acres for the Chugach National Forest. This is due to a slight difference in the roadless categories used in the FEIS.

Figure 3-73: Inventoried roadless areas.



Environmental Consequences

The decision to make an area a Wilderness can only be made by Congress. Once an area is designated as Wilderness, by Congress, only an act of Congress can change the designation and the management of the area would not be reconsidered in the next Forest Plan revision. Congress typically designates slightly different requirements for Wilderness in Alaska than for other states, such as it did in enacting ANILCA.

The most significant change from designation of Wilderness is than mineral exploration and development would be prohibited, subject to then existing rights (see also Minerals in this Chapter). Other uses and activities would not change much from what is occurring today. Without designation as Wilderness, there would likely be some small, incremental development in the area over time. Although the overall management would not change significantly if Wilderness were designated, some people fear that Wilderness designation would lead to greater restrictions on their traditional uses of the land. Foregoing Wilderness designation would have little affect on the environment. Most all opportunities to designate these areas as Wilderness, in the future, would remain (see Roadless Section in this chapter and Appendix C).

Table 3-75 displays the acres of recommended Wilderness by alternative. Table 3-76 shows the acres of recommended Wilderness for each roadless area, by alternative.

Table 3-75: Recommended Wilderness by alternative (M acres).

	Alternative							
	No Action	**Preferred**	**A**	**B**	**C**	**D**	**E**	**F**
Recommended Wilderness	1,637	1,866	0	871	1,347	2,590	3,392	4,456

Alternatives F, E and D recommend the highest amount of roadless lands for Wilderness designation. Alternative F recommends 82 percent, Alternative E 62 percent and Alternative D 48 percent. The Preferred Alternative recommends 34 percent of the roadless land for Wilderness classification. Alternatives C and B recommend the least amount of Wilderness for designation. Alternative C recommends 24 percent and Alternative B, 16 percent. Alternative A does not recommend any Wilderness. The No Action Alternative recommended 30 percent.

Recommending or designating an area as Wilderness would have no affect on adjacent lands. However, inholdings would be more difficult to access. The No Action Alternative contains 11,900 acres of private isolated lands (no access from outside the recommended Wilderness or from the coastline), Alternative E, 11,300 acres and Alternatives D and F, 16,100 acres. There would be no isolated lands under the Preferred Alternative and Alternatives A, B and C.

Although the number of acres recommended for Wilderness designation in the Nellie Juan-College Fiord Wilderness Study Area varies by alternative, the Forest

Service will continue to manage the entire Wilderness Study Area for its wilderness values until Congress considers the Wilderness Study. After Congress considers the Wilderness Study, the Revised Forest Plan will be amended to provide management direction for the areas not designated as Wilderness by Congress. The Preferred Alternative displays recommended prescriptions after Congress considers the Wilderness Study.

The effects analysis for the Wilderness Study Area displays the effects of the alternative's recommended prescriptions. The actual effects until Congress considers the Wilderness Study results will be the same in all alternatives, which is generally displayed in Alternative F, except that the area is not closed to mineral exploration and development. For effects on roadless areas if not recommended or subsequently designated as Wilderness, see the "Roadless Area" section of this Chapter.

Table 3-76: Recommended Wilderness by alternative by roadless area (M acres).

	Alternative							
Roadless Area	**No Action**	**Preferred**	**A**	**B**	**C**	**D**	**E**	**F**
Resurrection						140	169	168
Boston Bar							45	46
Johnson Pass							6	6
Kenai Lake							94	103
Kenai Mt.	48					115	101	227
Twentymile								113
Nellie Juan	684	545		392	448	607	693	694
PWS Islands	26	47		26	26	102	119	119
College Fiord	879	832		453	469	599	828	1,099
Fidalgo-Gravina							18	18
Montague Island							6	202
Hinchin-Hawkins					91	101	54	130
Copper Wetlands							36	69
Sheridan Glacier							61	165
Bering Lake		442			340	926	947	947
Tasnuna River							115	350
Total	**1,637**	**1,866**	**0**	**871**	**1,374**	**2,590**	**3,392**	**4,456**

Direct and Indirect Effects

Effects of Wilderness Designation on Heritage Resource Management

If archaeological or other cultural resources exist in any of the recommended Wilderness, these resources would be given additional protection through Wilderness designation since ground-disturbing activities are limited.

Effects of Wilderness Designation on Biodiversity Management

Wilderness management focuses on allowing natural conditions to prevail, usually by eliminating or limiting human intervention. Therefore, the overall effect of Wilderness designation would be to provide additional protection and maintenance of natural biological diversity.

Effects of Wilderness Designation on Fire Management
Natural fires would be allowed to play their natural ecological role. Fire control techniques would minimize ground disturbance. Natural barriers would be used to confine or contain fire where possible.

Fire management options on the Chugach National Forest have been mapped in accordance with direction in the "Alaska Wildland Fire Management Plan", 1998. This map is included on the CD-ROM version of the Revised Forest Plan. Mapped Fire Management options include: Critical; Full; Modified; and, Limited.

Most of the areas recommended for Wilderness designation are mapped as "Limited" or "Modified" Fire Management options. The "Limited" option recognizes areas where the cost of suppression may exceed the value of the resources to be protected, the environmental impacts of fire suppression activities may have more negative impacts on the resources than the effects of the fire. The intent of the "Modified" option is to provide a higher level of protection when fire danger is high. When fire danger is low there would be less of a suppression response.

Effects of Wilderness Designation on Insects and Disease Management
Natural outbreaks of insects and disease would be allowed to proceed naturally. However, they may be controlled if they threaten adjacent lands or resources.

Effects of Wilderness Designation on Vegetation Management
Ecological processes would be permitted to operate naturally. Vegetation management manipulation would be prohibited.

Effects of Wilderness Designation on Threatened, Endangered, and Sensitive Species Management
Populations of federally listed threatened and endangered species located within any designated Wilderness would be protected from potential development. Management activities are allowed to prevent loss of species.

Effects of Wilderness Designation on Fish and Wildlife Habitat Management
Habitat manipulation for wildlife would be prohibited unless it is specifically needed to restore natural ecosystem conditions or to perpetuate federally listed threatened or endangered species. Habitat manipulation for fish would be allowed, but it would have to blend with the landscape.

Effects of Wilderness Designation on Lands
Reasonable access would be granted to state and private lands, and to valid mining claims (ANILCA, Section 1110(b)).

Utility corridors and communication sites are not compatible with Wilderness objectives. Existing sites may be retained. Under ANILCA (Section 1310(b)) new sites could be permitted but they would have to blend with the landscape.

Effects of Wilderness Designation on Recreation Management
Managing the recreation resource for a primitive experience is a primary management activity in wilderness. Hiking, skiing, hunting, fishing, camping, and related low impact uses by the public would be allowed to continue. Trails and other appropriate wilderness facilities would be constructed and maintained by

primitive methods. Motorized equipment is prohibited except for fixed-wing airplanes, motorboats, and snowmachines for traditional activities as provided by ANILCA, Section 1110.

The public use and maintenance of cabins would continue. A limited number of new cabins or shelters could be constructed, if necessary, for public health and safety (ANILCA Section 1315 (c)). Temporary hunting and fishing facilities could continue to be used and new facilities could be constructed (ANILCA, Section 1316(a)).

Effects of Wilderness Designation on Subsistence Management
Wilderness would have no effect on subsistence management (ANILCA, Title VIII).

Effects of Wilderness Designation on Timber Management – Wilderness would not be available for timber harvest. Table 3-77 lists the approximate amount of tentatively suitable timber acres in recommended Wilderness by roadless area by alternative.

Effects of Wilderness Designation on Minerals Management – Subject to existing rights, on valid claims, designated Wilderness would be withdrawn from all forms of mineral entry (see Table 3-95 in Minerals section).

Table 3-77: Summary of tentatively suitable timber acres recommended for Wilderness by roadless area by alternative (M acres).

	Alternative							
Roadless Area	**No Action**	**Preferred**	**A**	**B**	**C**	**D**	**E**	**F**
Resurrection						1.6	2.3	2.7
Boston Bar							0.9	1.3
Johnson Pass								
Kenai Lake							4.0	4.1
Kenai Mt.						1.5	1.0	3.3
Twentymile							2.4	2.3
Nellie Juan	13.1	11.4		5.6	9.0	10.4	13.1	14.3
PWS Islands	2.3	7.2		2.3	2.4	15.6	17.8	17.8
College Fiord	22.9	13.9		23.3	32.3	44.4	49.8	49.9
Fidalgo-Gravina								
Montague Island							1.3	
Hinchin-Hawkins					20.3	21.7	12.4	28.5
Copper Wetlands								0.2
Sheridan Glacier								6.2
Bering Lake		34.6				74.1	73.6	73.7
Tasnuna River								
Total	**38.3**	**67.1**	**0**	**31.2**	**64.0**	**169.3**	**178.6**	**204.3**

EVOS Acquisition Areas – No EVOS-acquired lands are recommended for Wilderness designation.

Wild and Scenic Rivers – Wild River classification would prohibit any activities that would affect the free-flowing nature of the river, including the impoundment of water.

ANILCA 501(b) Lands – Wilderness designation would be compatible with the conservation of wildlife and fish on ANILCA 501(b) lands. The Sheridan Glacier, Bering Lake, and Tasnuna River Roadless Areas are partly within ANILCA 510 (b) lands.

Cumulative Effects

Designation of Wilderness would add to the National Wilderness Preservation System where ecological processes are largely unaffected by human influences. This could positively affect biological diversity by providing a larger areas where ecological processes are largely unaffected by human influences.

The Chugach National Forest is almost surrounded by land that is managed for its wilderness or roadless values. These areas include Chugach State Park, Kenai Fjords National Park, Kenai National Wildlife Refuge (contains two designated Wildernesses), and Wrangell-Saint Elias National Park and Preserve (largely designated Wilderness). Many other lands are roadless because of the their topography. As tourism and populations increase around Anchorage, there would be increased pressures on wilderness areas for a variety of uses. However, much of the Chugach would remain roadless because of its rugged topography and glacier features.

There are currently 58 million acres of designated Wilderness in Alaska. Within the United States, the Forest Service manages over 400 Wilderness areas totaling over 35 million acres (USDA Forest Service, 1998a). Within Alaska, there are 19 designated national forest Wildernesses totaling 5,788,657 acres. All of these areas are located on the Tongass National Forest in Southeast Alaska.

Cumulative effects resulting from Wilderness designation would include present and future loss of commodity production (principally wood products and minerals) and the loss of some fish and wildlife habitat enhancement opportunities. Some recreational pursuits in the future could be affected by some of the limitations prescribed by wilderness management, however designation would provide outstanding opportunities for recreation activities relying on a primitive setting.

Production of Natural Resources

Forest Products

Minerals

Forest Products

Introduction

Since the Chugach National Forest's creation in 1909, both commercial and personal use timber harvest has been a common activity. Specific areas of the Forest with road or water access were used for the harvesting of wood products. Commercial logging for railroad ties, mine props and construction materials dates back to the late 1800s. Much of this timber harvest occurred on the Kenai Peninsula, although some harvest occurred in Prince William Sound and Afognak Island before its selection and transfer under ANSCA primarily during the late 1960s and early 1970s (USDA Forest Service 1989b). Personal use harvesting of firewood, cabin logs, poles, Christmas trees, transplant trees and shrubs, and other forest products has remained small, but steady and, like commercial harvest, is generally limited to those areas that have road or water access. Despite the level of historical forest products harvesting over the last 90 years, most of the forested lands have never been cut and 99 percent of the Forest remains in an unroaded condition.

Legal and Administrative Framework

- The **National Forest Management Act (NFMA) of 1976** sets forth the requirements for Land and Resource Management Plans for the National Forest System. Regulations on land and resource management planning (36 CFR 219) require the identification of areas suitable and available for timber harvest and the allowable sale quantity (ASQ) from those lands. In addition, 36 CFR 219 requires the supply-and-demand situation for resource commodities to be analyzed.

Key Indicators

The following are key indicators for Forest Products:

Suitable Timberlands Scheduled for Chargeable Timber Harvest

- Estimated average annual demand for commercial forest products
- Acres of suitable timberlands allocated for timber production by prescription category and management area prescription
- Annual allowable sale quantity from suitable timberlands (chargeable board/cubic foot volume of sawtimber and utility volume)

Unsuitable Forestland Planned for Nonchargeable Timber Harvest

- Estimated average annual demand for personal and free use forest products
- Annual acres of unsuitable forestland planned for vegetation management by small commercial, personal and /or free use timber harvest

- Annual total board/cubic foot volume of nonchargeable forest products (sawtimber, poles, cabin logs, firewood) available for small commercial, personal, and/or free use

Resource Protection Measures

Mitigation measures to reduce or prevent significant effects of timber management on other resources are outlined in the Revised Forest Plan standards and guidelines for timber and other resource activities.

Affected Environment

Forest Land Base

Forested lands occupy slightly less than 1.2 million acres or about 23 percent of the Chugach National Forest. The remaining 77 percent is non-forested types such as water, ice, rock, muskeg, and alpine vegetation. The forested lands vary from sparse muskeg to heavily timbered stands.

The forests of the Chugach Forest are primarily the western hemlock-Sitka spruce forest type accounting for 84 percent of the forested land base. This type is a segment of the temperate rain forest that occupies a coastal strip 2,000 miles long from northern California to Southcentral Alaska. The remaining 15 percent of forested lands support cottonwood, white spruce, aspen, paper birch, and Alaska yellow-cedar forest types.

Current Condition of the Forest Land Base

About 27 percent of the forestlands or 319,000 acres of the Chugach forests are "Timberlands." Timberlands are forests biologically capable of producing industrial wood products. Previously these lands were called commercial forestlands and are often called "productive" forestlands. In addition to timberlands, there are about 877,000 acres (73 percent), which are classified as "Other Forest Land." These lands are not capable of producing industrial forest products, but are of major importance for watershed protection, wildlife habitat, recreation and other uses. Other forestlands are incapable of yielding crops of industrial wood usually because of adverse site conditions. These conditions include sterile or poorly drained soil, sub alpine conditions, and steep rocky areas where topographic conditions are likely to prevent management for timber production. Other forestland has been called noncommercial or "unproductive" forestland.

History of Land Selections and Legislative Withdrawals

National legislation has reduced the available timberlands of the Chugach Forest. About 103,000 acres have either been selected by the state or Native corporations or legislatively withdrawn. These lands contain about 37,000 acres of timberland that are no longer available for timber harvest considerations.

These legislation acts includes:

- **The Alaska Statehood Act of 1958**. This act authorized the selection of up to 400,000 acres from the Chugach and Tongass national forests in Alaska for the development and expansion of Alaska communities. About 390,000 acres of the state selections on the Chugach National Forest are timberlands.
- **The Alaska Native Claims Settlement Act of 1971 (ANSCA)**. ANSCA authorized the transfer of about 44 million acres throughout the State of Alaska from federal management to private ownership. Under ANSCA, Native regional and village corporations were given the opportunity to select from National Forest System lands. Approximately 417,000 acres have been selected to date.
- **The Alaska National Interest Lands Conservation Act of 1980 (ANILCA).** ANILCA transferred about 1,581,000 million acres of public domain to the Chugach, which have not been inventoried yet, however the additions are estimated to have little commercial timber value.

As a result of the above legislation, there are approximately 1,093,000 acres of available forestland on the Chugach. Available timberlands amount to 379,850 acres.

Tentatively Suitable Forest Lands

Not all of the remaining available timberland on the Chugach is suitable for timber harvest. The NFMA requires the Secretary of Agriculture to identify lands not suited for timber production due to physical limitations and other pertinent factors. The NFMA also included consideration of economic factors as a requirement in the identification of suitable lands.

A timber resource land suitability analysis has been completed for the Forest Plan revision (FEIS, Appendix B). Tentatively suitable lands have the biological capability, and availability, to produce commercial wood products. To be considered tentatively suitable, the forested land must:

- be at least 10 percent occupied by trees or have formerly had such tree cover, and not be developed for non-forest uses;
- be capable of harvest with available technology to ensure timber production without irreversible resource damage to soil productivity or watershed conditions;
- be capable of being restocked within five years after final harvest; and,
- not be withdrawn from timber production by an Act of Congress, the Secretary of Agriculture or the Chief of the Forest Service.

Based upon the tentatively suitable analysis, there are 282,610 acres of timberland available for timber harvest on the Chugach National Forest.

Current Condition of the Timber Resource

There are eleven forest types within the Chugach (Table 3-78). The western hemlock, mountain hemlock, Sitka spruce, and hemlock-Sitka spruce forest types account for about 84 percent of the total forested land area. These types in addition to black cottonwood are found in all three geographic areas of the Chugach (Kenai Peninsula, Prince William Sound, and Copper River Delta).

The white spruce, black spruce and birch forest types are found almost exclusively on the Kenai Peninsula portion of the Forest. The white spruce type has experienced significant mortality since the early 1980s from a spruce bark beetle epidemic that has encompassed most of the Kenai Peninsula and Southcentral Alaska.

Table 3-78: Forest type composition (percentage) on forested lands on the Chugach National Forest.

Forest Type	Timberlands		Other Forest Lands		Total Forest
	Available	Reserved	Available	Reserved	
Unclassified	0.0	0.0	7.5	0.0	7.5
Black Spruce	0.0	0.0	0.1	0.0	0.1
White Spruce	2.6	0.0	0.7	0.0	3.2
Hemlock-Spruce	4.5	2.2	4.0	0.0	10.8
Sitka Spruce	7.2	0.4	12.9	0.0	20.5
Mountain Hemlock	5.3	0.6	27.5	9.6	43.0
Western Hemlock	8.6	0.4	0.4	0.0	9.4
Alaska Cedar	0.0	0.0	1.6	0.0	1.6
Other Nonstocked	0.0	0.0	0.0	1.6	1.6
Black Cottonwood	1.0	0.1	0.1	0.0	1.2
Birch	1.0	0.0	0.0	0.0	1.1
Total	**30.3**	**3.6**	**54.9**	**11.1**	**100.0**

Source: Forest Resources of Prince William Sound and Afognak Island, Alaska: Their Character and Ownership, 1978,PNW-RB-163 and Timberland Resources of the Kenai Peninsula, Alaska, 1987,PNW-RB-180.

Age Class Distribution

As shown in Table 3-79, the Chugach National Forest is a mix of old-growth stands, naturally regenerated forest, and planted forest. Harvest-created young-growth amounts to less than one percent of the total timberlands. Timberlands are classified into five stand conditions: (1) old-growth sawtimber, (2) young-growth sawtimber, (3) poletimber, (4) seedling and sapling, and (5) nonstocked. For timber inventory purposes, stands of trees 150 years old or older are designated as old-growth. Nearly 66 percent of timberlands meet the criteria for old-growth sawtimber while 92 percent is sawtimber. Timberlands greater than 150 years of age cover 66 percent (186,523 acres) of the 282,610 acres in the tentatively suitable land base.

Table 3-79: Estimated age class distribution (M acres) on the Chugach National Forest.		
Age Class (Years)	All Timberlands	Tentatively Suitable Timberlands
0-5	3,195	2,826
5-40	12,779	11,304
40-70	12,779	11,304
70-150	79,867	70,653
150+	210,859	186,523
Total	**319,470**	**282,610**

Source: Forest Resources of Prince William Sound and Afognak Island, Alaska: Their Character and Ownership, 1978,PNW-RB-163 and Timberland Resources of the Kenai Peninsula, Alaska, 1987,PNW-RB-180.
Note: Data from the above inventories has been adjusted for land ownership changes since the inventories.

Timber Inventory Methodology and Scientific Accuracy

In 1978, an extensive point sampling system inventory was completed for the Chugach National Forest. The 1978 inventory was designed to achieve an estimate of the standing volume on the Forest within certain error limitations. Sampling errors of the area and volume, which resulted, met the requirements of FSM 2409.13 (Plus or minus 10 percent per billion net cubic feet at a 68 percent confidence interval) and are displayed in Table 3-80.

Table 3-80: Relative sampling errors at the 68 percent confidence level (percent).		
	Design Sampling Error	Sampling Error Achieved
Prince William Sound and Copper River 1978 Inventory		
Net Growing Stock Volume on Available Timberland \1 Per Billion cubic feet	10.0	10.5
Net Growth of Growing Stock on Available Timberlands \1 Per Billion cubic feet	10.0	2.6
Kenai Peninsula 1987 Inventory		
Net Growing Stock Volume on Available Timberland \2 Per Billion cubic feet	10.0	9.2
Net Growth of Growing Stock on Available Timberlands \2 Per Billion cubic feet	10.0	1.7

\1 - Source: Forest Resources of Prince William Sound and Afognak Island, Alaska: Their Character and Ownership, 1978,PNW-RB-163.
\2 – Source: Timberland Resources of the Kenai Peninsula, Alaska, 1987,PNW-RB-180.

In 1987, a timber resource inventory of the Kenai Peninsula was completed for all landowners. For the Forest Plan revision, the 1987 Kenai timber inventory was used to update the Kenai Block of the 1978 inventory. Collectively, these inventories were not designed to collect all timber resource information nor were they designed for comparison of individual plot results to the Forest's Land and Vegetation Cover Type maps (also known as timber type maps) polygons or volume strata.

The results of 1978 Forestwide and 1987 Kenai Peninsula inventories (Table 3-81) show that the Chugach National Forest had a net growing stock of 1.544 billion cubic feet on available timberlands (4.1 thousand cubic feet per acre). This would indicate that the 282,610 acres of tentatively suitable land would have

approximately 1.163 billion cubic feet of growing stock. The net growing stock for productive forestland or all timberlands was 1.755 billion cubic feet or 4.2 thousand cubic feet per acre.

Table 3-81: Net volume of growing stock on forested lands on the Chugach National Forest.

Revision Forest Inventory All Inventory Blocks Combined	National Forest Sum	Net Volume of Growing Stock Cubic Feet Sum	Net Volume of Sawtimber Board Feet Sum
Land Classification	**Acres**	**CF**	**BF (I1/4)**
Timberland, Available (Unreserved)	375,385	1,544,348,619	7,388,164,044
Timberland, Reserved	45,238	211,073,740	1,065,259,167
Total Timberland	**420,623**	**1,755,422,359**	**8,453,423,211**
Other Forest Land, Unreserved	680,929	388,031,966	1,539,874,254
Other Forest Land, Reserved	138,173	76,522,516	313,337,990
Total Other Forest Land	**819,102**	**464,554,482**	**1,853,212,244**
Total Forest, Unreserved	1,056,314	1,932,380,585	8,928,038,298
Total Forest, Reserved	183,411	287,596,257	1,378,597,157
Total Forest	**1,239,725**	**2,219,976,841**	**10,306,635,455**

Source: Forest Resources of Prince William Sound and Afognak Island, Alaska: Their Character and Ownership, 1978, PNW-RB-63 and Timberland Resources of the Kenai Peninsula, Alaska, 1987, PNW-RB-180.

Table 3-82 shows the net annual growth on available timberlands on the Forest. The total net annual volume growth on the Forest's growing stock is 9.3 million cubic feet per year while the net annual growth of the Forest's sawtimber is 29.3 million board feet per year.

Table 3-82: Net annual growth of growing stock on available timberlands on the Chugach National Forest (Forestwide summary).

Forest Type	National Forest Available Timberland	Net Annual Growth Of Growing Stock	Net Annual Growth Of Sawtimber
Conifer	**Acres**	**Cubic Feet (CF)**	**Board Feet BF (I1/4)**
Black Spruce	0	0	0
Western Hemlock	106,720	2,736,064	9,000,563
Mountain Hemlock	65,619	553,690	106,720
Hemlock-Spruce	56,378	3,630,848	9,833,188
Sitka Spruce	89,578	2,528,038	10,722,592
White Spruce	31,750	(226,035)	296,814
Total Conifer	**350,045**	**9,222,606**	**29,959,876**
Hardwood			
Black Cottonwood	12,319	110,740	365,925
Paper Birch	12,974	(22,163)	(996,216)
Quaking Aspen	0	0	0
Total Hardwood	**25,293**	**88,577**	**(630,292)**
Nonstocked	48	301	1,873
Total	**375,385**	**9,311,484**	**29,331,458**

Source: Forest Resources of Prince William Sound and Afognak Island, Alaska: Their Character and Ownership, 1978,PNW-RB-163 and Timberland Resources of the Kenai Peninsula, Alaska, 1987,PNW-RB-180.

Current Practices

Regeneration Methods

Historically, clearcutting, with reliance on natural seeding, has been the most commonly used silvicultural system in the western hemlock-Sitka spruce forest type found in Prince William Sound and Copper River watersheds. Clearcutting is used where timber production is the primary use and where it is the optimal method. The clearcutting method is favored for the following reasons: (1) clearcutting increases exposure to the sun, which raises soil temperature, speeds up organic decomposition, and thus improves soil productivity; (2) the regeneration of Sitka spruce is favored in open sites with disturbed soils, (3) clearcutting aids in controlling dwarf mistletoe by eliminating infected overstory trees, (4) minimizes windthrow an logging damage, (5) logging costs are lower than with other systems. The clearcut method has proven very successful in the regeneration of healthy forested stands.

However, the practice of clearcutting has been, and continues to be, a controversial issue. The main concerns center around the esthetics of clearcuts, and the loss of old-growth forest stands and their attendant wildlife resources. The Alaska Region has been using alternative silvicultural methods other than standard clearcut harvesting. These methods involve both the harvest of trees singly or in small groups (typically called uneven-aged management), leaving residual trees in clearcuts, and extending the “rotation age” of harvesting – the

time period at which a previously harvested area or stand can be harvested again. These various options are briefly described (see also the Revised Forest Plan, Forestwide standards and guidelines).

Uneven-aged Systems. This is typically the harvesting of single trees from with a stand, or of small groups of trees (usually less than two acres). This method maintains a multi-aged, multi-layered stand structure by removing some trees in all age groups. Very little is known about the ultimate success of uneven-aged methods in Southeast and Southcentral Alaska.

Two-aged Systems. In this system, approximately 10-20 percent of a stand is left as residual (or reserve) trees, both individually and in patches, and the rest of the stand is harvested. The reserve trees and patches remain unharvested, and provide structural diversity and an older aggregation of trees within the otherwise young-growth stand.

Extended Rotations. In the coastal forests of Prince William Sound and Copper River, old-growth forest conditions are normally not reached until a stand is 150 years old or older. Extending the time period before a young-growth stand is scheduled for a second harvest gives the stand more time to acquire at least some of the characteristics of old-growth forests. Extended rotations also mean either fewer entries into a given area within a given time period or a smaller amount of harvest when entries are made, but can increase the need for roads if equivalent volumes are to be harvested. Currently, young-growth is projected to be harvested on an average 160-year rotation cycle in both these areas under management area prescriptions specifying a normal rotation and a 200-year rotation cycle under management area prescriptions specifying an extended rotation. Due to less productive sites on the Kenai Peninsula, the normal rotation cycle is 200 years and 250 years in management area prescriptions specifying an extended rotation.

Young-Growth Management

After harvest, young-growth stands can be treated through thinning and other methods to promote growth and tree quality. In the recent years, such timber stand “improvements” have typically consisted of pre-commercial thinning and have averaged 136 acres per year.

Yarding Methods

In the last twenty years almost all timber harvest on the Forest has been confined to the Kenai Peninsula where tractor yarding is used to move logs to landings for loading and transport via trucks.

Chugach Timber Program

Figure 3-74 combines fragmented records for annual timber harvest during the period 1909 to 1979 with available removal records for the 1980 to 1999 period.

As displayed in Figure 3-74, the average amount of timber cut and removed from the Chugach Forest over the last 90 years is 3.8 million board feet per year. Annual harvest volumes ranged from a low of 0.4 million board feet in 1999 to a high of 11.7 million board feet around 1910 with a marked decrease associated with the Great Depression of the 1930s. Figure 3-74 also displays the annual average harvest rate over the last 20 years (1980-1999), which has declined to 1.8 million board feet per year. The down sloping regression trend line for the 90 year period indicates that the average annual harvest rate has been steadily declining despite cyclical bursts above the 90 year average. The past five years (1996-2000), the average annual harvest was 1.5 MMBF.

Figure 3-74: Historical timber harvest on the Chugach National Forest 1909-1999.

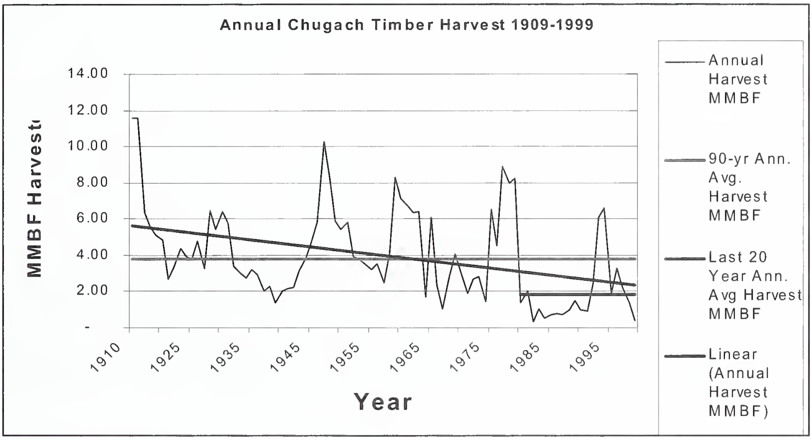


Figure 3-75 displays timber harvest on the Forest over the same 90-year period on a decadal basis. The average rate of timber harvest per decade has been 33.8 MMBF per decade.

Figure 3-75: Historical timber harvest on the Chugach National Forest, 1909-1999, by decade.

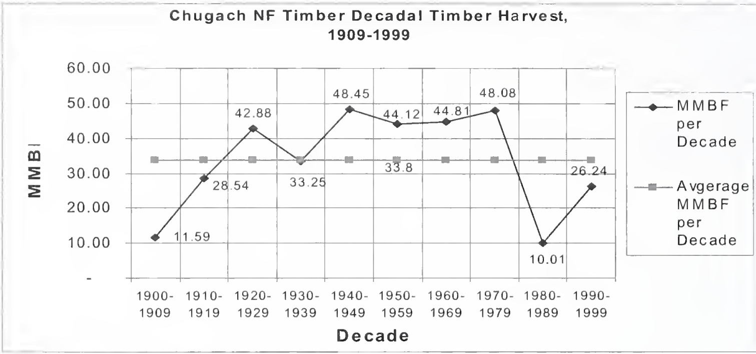


Table 3-83 displays the annual combined offer, sold, and harvest of net saw logs and utility logs between 1980 and 1999 for the commercial program. Since 1980, the Forest has offered for sale an average of 8.1 million board feet of timber annually. Approximately 31 percent (2.5 million board feet) of the annual average offer was actually sold while 22 percent (1.8 million board feet) was actually harvested. Personal use permits have ranged from 100,000 to 500,000 board feet per year over the past 13 years. Free use permits between 1994 and 1997 averaged 555,000 board feet per year with an additional estimated volume of 50,000-100,000 board feet of dead and down timber for which no permit is needed.

Under the 1984 Forest Plan (1985-1999), the average annual sale offering decreased to 3.5 million board feet, however the annual average volume sold increased to 3.0 million board feet and the annual average volume harvested increased to 2.0 million board feet. With the exception of the Montague Island Chugach Alaska road right-of-way volume and some minor personal use sale volume on the Cordova Ranger District, all timber harvest on the Forest since 1985 has been limited to the Kenai Peninsula.

Table 3-83: Timber sale volume offered, sold, and harvested, 1980-1999.

Volume in MMBF

FISCAL YEAR	OFFER CNF TOTAL SAW+UTIL	SOLD CNF TOTAL SAW+UTIL	HARVESTED CNF TOTAL SAW+UTIL
1980	40.8	0.2	1.3
1981	16.6	1.0	1.8
1982	39.6	0.7	0.4
1983	10.2	0.8	1.1
1984	2.0	1.8	0.5
1985	2.0	0.1	0.7
1986	2.0	0.8	0.8
1987	3.1	1.5	0.7
1988	2.0	0.8	1.0
1989	1.1	3.3	1.5
1990	4.0	4.2	0.5
1991	7.1	1.3	0.9
1992	5.0	2.3	2.4
1993	2.8	11.8	6.1
1994	1.2	2.8	6.6
1995	5.6	3.6	1.9
1996	2.1	2.7	3.3
1997	14.5	9.5	2.2
1998	0.1	0.2	1.4
1999	0.5	0.2	0.4
20 Year Total	**162.3**	**49.6**	**35.4**
Annual Average	**8.1**	**2.5**	**1.8**
% of Total Offer	**100.0%**	**30.6%**	**21.8%**

Source: R10-Regional Office, Forest Management, 1999.
Definitions:
OFFER - Volume offered for sale from normal timber sale contracts made to independent timber sale purchasers.
SOLD - Offered Volume that Sold in normal timber sale contracts made to independent timber sale purchasers.
HARVESTED - Sold Volume that was harvested in normal timber sale contracts made to independent timber sale purchasers.
SAW - Saw log - Volume from logs that are suitable in size and quality for the production of dimension lumber.
UTIL - Utility - Volume from logs that do not meet minimum requirements for sawtimber but are suitable for the production of usable chips.

Declining sale volumes have occurred throughout the Alaska Region, including the Chugach National Forest. Between 1980 and 1999, harvest volume peaked in 1994 at 6.6 million board feet (spruce beetle salvage on the Kenai Peninsula) and has since declined to 400,000 board feet in 1999. While the Forest's volume varies annually, its share of the regional sale volume has remained a consistent 1-3 percent of the regional total. Although the Forest's volumes are minor relative to regional and state sale levels, local purchasers consider it to be important because of the unique market it has served.

Uncut volume under contract is declining on the Forest, as it is throughout the region. As of December 31, 2001, the Forest has five remaining salvage timber sales with a total uncut volume of 1.2 million board feet (Table 3-84).

Table 3-84: Uncut timber volume under contract.

Sale Name	Remaining Uncut Volume (MBF[1])	Remaining Value ($)
Frenchy Creek Salvage	864	$25,243
Alder Creek Salvage	137	2,680
Lv Ray Salvage	68	1.917
Granite Creek Decks	54	1,070
Trail River Decks #1	86	2,851
Total Sales	**1,209**	**$33,761**

[1] MBF – thousand board feet

On the Kenai Peninsula, salvage harvesting of spruce bark beetle infested or killed white (Lutz) spruce has been the most commonly used silvicultural system, with a reliance on natural seeding on about 22 percent and planting on 78 percent of the average 227 acres harvested annually (1985-1997). Between 1974 to 1999, 2,545 acres have been harvested with commercial timber sales, 16 acres harvested in firewood fee areas, 189 acres harvested for fuel reduction, 362 acres harvested for personal use, and 44 acres harvested by the Forest Service. During the same period, pre-commercial thinning has occurred on 215 acres. The total area of timber removal by harvest during this period was 3,371 acres compared to 4,276 acres of prescribed burns.

The total acres treated by timber harvest and thinning from 1974 to 1999 account for less than 0.3 percent of all forested lands.

Timber Supply and Demand

Commercial Program

The primary sources of commercial quantities of timber within Southcentral Alaska are private corporations (principally Native corporations formed through the Alaska Native Claims Settlement Act), the State of Alaska, the Kenai Peninsula Borough, the Mat-Su Borough, private landowners, and the Chugach National Forest. Between 1986 and 1996, timber harvest volume from the Forest amounted to 1.48 percent (20.9 million board feet) of the total 1,408 million board feet harvested in Southcentral Alaska (Figure 3-76). Timber harvested from Forest lands is required to be processed, while other timber can be exported before processing.

Figures 3-77 and 3-78 indicate that most of the Chugach National Forest harvest volume during this period was low value utility volume (spruce beetle killed timber from the Kenai Peninsula) rather than higher value saw log volume. The percent of total saw log and utility volume in the Southcentral Alaska harvest during the 1986-1996 period is 0.8 and 20.7, respectively.

Figure 3-76: Southcentral Alaska timber harvest by ownership, 1986-1996.

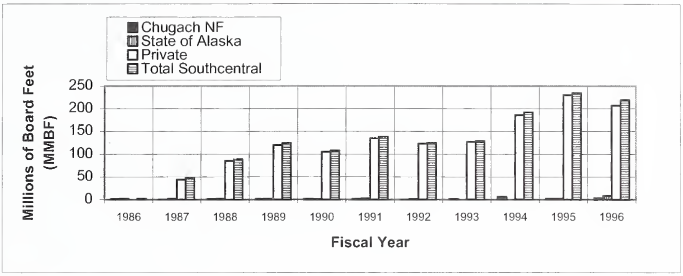


Figure 3-77: Sawlog harvest volume.

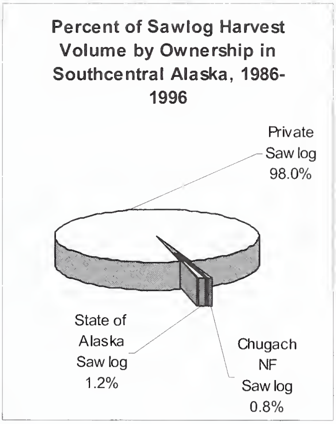
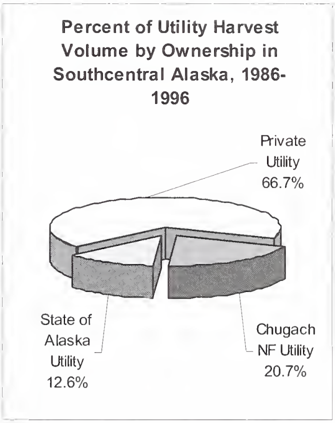


Figure 3-78: Utility harvest volume.



The commercial timber demand assessment for the Forest was derived from a 1997 study on the Tongass National Forest. In the study, Brooks and Haynes (1997) concluded that derived demand for national forest timber in Alaska is projected to range from 132 to 223 million board feet in the next decade (2001-2010). While the study was done for the Tongass Forest Plan revision, their analysis included saw log and utility volume from both the Tongass and Chugach National Forests.

The Chugach annual average timber harvest represents 0.8 percent of the Alaska Region's total, with the remainder from the Tongass. Derived demand for the Chugach was obtained by applying the Chugach annual harvest of 0.8 percent for the Alaska Region to Brooks and Haynes projected demand range of

132 to 223 million board feet over the next decade. This equates to a projected demand range for the Chugach National Forest ranging from 1.1 to 1.8 million board feet per year in the next decade (2001-2010) (Brooks and Haynes 1997). The upper demand projection of 1.8 million board feet per year is also the annual average timber harvest volume on the Chugach National Forest during the last 20 years (1980 to 1999)(see Table 3-20.6).

The Forest's lack of roads and other infrastructure makes many of its potential products inaccessible or economically infeasible (particularly during low to middle market cycles) to purchasers, processing facilities or personal use users. During the most recent high market cycle of the early 1990s, low value wood fiber from the Forest was harvested and processed for chips as far away as Ketchikan, by Louisiana Pacific prior to the shutdown of its mill in 1998 and in Homer, by Circle D-E. However, with the requirement for domestic processing of logs from national forest lands in Alaska, no major processing facilities in Southcentral Alaska, and high transportation costs to markets both inside and outside the state, it is highly probable that demand for commercial quantities of timber from the Chugach will continue to remain at low levels during the planning period.

Personal and Free Use Program

Future personal and free use demand is estimated to be 655 MBF board feet per year annually and is likely to increase over the years as local populations increase.

Special Forest Products

Special forest product markets include Christmas trees, transplant trees, conks, boughs, shrubs, forbs, etc. Demand for special forest products has historically been low with few permits issued annually. Demand is estimated to remain low. The one exception could be the commercial demand for shrubs and forbs for botanical uses. The Forest has received several requests for species information over the last several years; however, to date no commercial permits have been requested.

Environmental Consequences

General Effects

Timber may be cut and removed to contribute to the allowable sale quantity (ASQ) with the intent to create or improve stands that will meet future timber products needs. This includes live trees that meet the utilization standards on suitable lands, and dying trees, which at the time of the ASQ calculations was live volume.

Management area prescriptions that are suitable for timber harvest to meet timber goals and contribute to ASQ are 312 (Fish, Wildlife and Recreation), 314 (Forest Restoration), 321 (ANILCA 501(b)-3), and 411 (Resource Development). Timber harvest may be allowed under other management area prescriptions, but only to meet resource objectives. Harvest in these areas would not contribute to ASQ but would contribute toward the total timber sale program quantity.

Timber may be cut and removed to meet vegetation management objectives, such as hazard tree removal, fuel reduction, wildlife habitat maintenance and improvement, improvement of scenic vistas, and ecosystem management. In addition, timber affected by natural mortality events (fires, windstorms, insect and disease infestations) may be harvested under salvage sales to serve objectives other than commercial product offerings. Commercial products may be a byproduct of meeting these objectives. The nonchargeable volume (does not contribute to ASQ volume) of timber cut and removed to meet these objectives varies among alternatives based on objectives and available funding. Table 3-85 displays allowable sale quantity and timber sale program quantity at the full budget level for the first decade and chargeable and non-chargeable volume offered at the historic budget level for the first and fifth decades.

Timber harvesting could be done to accomplish biodiversity goals. If analyses indicate that current vegetation differs greatly from historical norms, vegetation manipulation, including timber cutting, may be used to try to emulate natural patterns of composition and structure. Timber products derived from this cutting could be sold commercially. Biodiversity accomplishments would be more pronounced in the No Action Alternative and Alternatives A and B, than in the Preferred Alternative and Alternatives C, D, E, and F.

As standards and guidelines are applied to projects, harvest volumes may be reduced based on site-specific situation and analysis. Examples are water quality guidelines, or wildlife and heritage resource protection measures could cause a reduction in volume harvested. Where possible, the effect of these standards and guidelines has been taken into account in the calculation of the ASQ. However, the ASQ is considered a ceiling, not a target, and certain conditions could arise in which standards and guidelines may limit the actual volume available.

Suitable Timber Lands

There are 282,610 acres of tentatively suitable lands, as defined by NFMA regulations (36 CFR 219.14(a)). This represents about 5.1 percent of the total Forest acreage and is the same for all alternatives. Appendix B of the FEIS contains a detailed discussion of the tentatively suitable determination process.

During the alternative development process, additional lands within the tentatively suitable timber base (282,610 acres) were determined to be inappropriate for timber production (36 CFR 219.14) in accordance with each alternative's objectives, and were classified as unsuitable.

The amounts of tentatively suitable land and lands designated as suitable for timber production, as well as the allowable sale quantity for each alternative are displayed in Table 3-85.

The acreage of suitable land on the Forest would vary from 0 percent in the Preferred Alternative and Alternatives C, D, E, and F to 1.1 percent in Alternative B, 7.4 percent in the No Action Alternative, and 2.7 percent in Alternative A. The average allowable sale quantity during the first decade from lands designated as

suitable for timber production ranges from a low of 0 MMCF (0 MMBF) in the Preferred Alternative and Alternatives C, D, E, and F to 12.9 MMCF (61.1 MMBF) in Alternative B, 16.0 MMCF (74.9 MMBF) in the Not Action Alternative, and 34.6 MMCF (162.9 MMBF) in Alternative A. (Reference FEIS, Appendix B, B-10-B-25 for a description of the timber resource analysis process, including the calculation of the allowable sale quantity and long-term sustained yield.)

Removing land from the suitable land base reduces both potential ASQ and long-term timber growth and yields. While the effect is not linear, the magnitude of the reduction is generally related to the proportion of lands removed. The timber production lost is irretrievable but is not irreversible. If future designation of these lands were changed to allow timber management, it would be possible to resume timber management activities.

Where land is dedicated to road construction or development of facilities, minerals or rock excavation, the loss of land for timber production is generally irretrievable and may be irreversible. Similarly, the occurrence of landslides or excessive erosion can significantly degrade soil productivity thus reducing the potential forest growth and yield.

Table 3-85: Land classification (acres) - tentatively suitable timberlands, suitable timberlands.

Timber Land Suitability Classification	No Action	Preferred	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Total National Forest (item 1 plus item 2)	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**
1. Non-Forest Land (includes water)	4,295,540	4,295,540	4,295,540	4,295,540	4,295,540	4,295,540	4,295,540	4,295,540
2. Forest Land	1,196,040	1,196,040	1,196,040	1,196,040	1,196,040	1,196,040	1,196,040	1,196,040
3. Forest Land Withdrawn from Timber Production	103,250	103,250	103,250	103,250	103,250	103,250	103,250	103,250
4. Available Forest Land (item 2 minus item 3)	1,092,790	1,092,790	1,092,790	1,092,790	1,092,790	1,092,790	1,092,790	1,092,790
5. Non-productive Forests: Not capable of producing crops of industrial wood	712,940	712,940	712,940	712,940	712,940	712,940	712,940	712,940
6. Available Timberlands (PFL) (Item 4 minus item 5)	379,850	379,850	379,850	379,850	379,850	379,850	379,850	379,850
7. Timberlands Physically Unsuitable	74,630	74,630	74,630	74,630	74,630	74,630	74,630	74,630
8. Timberlands Inadequate Information	22,610	22,610	22,610	22,610	22,610	22,610	22,610	22,610
9. Tentatively Suitable Timberlands (Item 6 minus items 7 and 8)	282,610	282,610	282,610	282,610	282,610	282,610	282,610	282,610
Percent of Total Forest Lands Tentatively Suitable for Timber Production	**23.60%**	**23.60%**	**23.60%**	**23.60%**	**23.60%**	**23.60%**	**23.60%**	**23.60%**
10. Tentatively suitable timberlands not appropriate for timber production:								
a. Resource protection (Forestwide standards and guidelines)	73,360	73,360	73,360	73,360	73,360	73,360	73,360	73,360
b. Pending withdrawal, productive Wilderness (Recommended or Study Area)	28,530	98,300	0	20,790	42,270	125,080	131,390	164,370
c. Pending withdrawal, productive Selected Lands (State or Native)	0	430	0	70	470	1,230	4,330	4,840
d. Not appropriate - RNAs	1,970	2,130	920	2,580	2,580	3,610	3,170	3,610
e. Not appropriate - Other Developed Visitor Facilities	0	1,210	0	0	0	300	0	60
f. Not appropriate - Dispersed Primitive Recreation	0	450	0	1,590	1,260	1,260	10,470	0
g. Not appropriate - Dispersed Backcountry Recreation	45,030	67,040	54,440	57,750	70,540	47,580	49,050	23,150
h. Not appropriate - Sensitive Animal	0	2170	530	1,480	1,480	3,260	0	880
i. Not appropriate - Fish & Wildlife Conservation Areas	54,810	28,310	3,140	63,540	78,530	22,080	9,110	9,630
j. Not appropriate - Mineral Claims	350	350	350	350	350	350	350	350
k. Not appropriate - Transportation/Utility/Electronic Site Corridors	730	520	730	730	730	730	730	730
l. Not appropriate - Special Alternative Management Direction	0	0	0	0	3,660	0	0	0
m. Not Appropriate – Economic feasibility	0	0	0	0	0	0	0	0
n. Unsuitable – Not needed to meet Alt. Mgmt. Objectives per CFR 219.14(c)(3)	0	8,340	0	0	7,380	3,770	650	1,630
Total (Items 10a through 10n)	204,810	282,610	133,470	222,240	282,610	282,610	282,610	282,610
11. Net Remaining Acres (Item 9 minus Item 10 a-n)	77,800	0	149,140	60,370	0	0	0	0

Table 3-85 (continued): Land classification (acres) - tentatively suitable timberlands, suitable timberlands.

Timber Land Suitability Classification	No Action	Preferred	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
12. Scheduled Suitable Forest Lands								
a. Scheduled with timber emphasis	0	0	38,280	3,130	0	0	0	0
b. Scheduled with fish, wildlife & recreation emphasis	77,800	0	110,860	57,240	0	0	0	0
Percent of total forest lands that are scheduled for timber production	**6.5%**	**0.0%**	**12.5%**	**5.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Allowable Timber Harvest Acres (Annual) – Even-Aged Mgmt.	296	0	617	233	0	0	0	0
Allowable Timber Harvest Acres (Annual) – Un-even-Aged Mgmt.	74	0	154	58	0	0	0	0
Allowable Timber Harvest Acres (Annual) - Total	370	0	771	292	0	0	0	0
Allowable Timber Harvest Acres (1st Decade)	3,697	0	7,714	2,917	0	0	0	0
Allowable Timber Harvest Acres (5th Decade)	18,485	0	38,570	14,587	0	0	0	0
Allowable Sale Quantity – Cubic Feet (1st Decade)								
Saw log (MMCF)	12.3	0.0	27.2	9.9	0.0	0.0	0.0	0.0
Utility (MMCF)	3.8	0.0	7.4	3.0	0.0	0.0	0.0	0.0
Total (MMCF)	**16.0**	**0.0**	**34.6**	**12.9**	**0.0**	**0.0**	**0.0**	**0.0**
Allowable Sale Quantity – Board Feet (1st Decade)								
Saw log (MMBF)	57.9	0.0	128.7	47.4	0.0	0.0	0.0	0.0
Utility (MMBF)	17.0	0.0	34.2	13.7	0.0	0.0	0.0	0.0
Total (MMBF)	**74.9**	**0.0**	**162.9**	**61.1**	**0.0**	**0.0**	**0.0**	**0.0**

Timber Management Intensity

Suitable timberlands are allocated to three broad yield categories according to the intensity of timber management desired to meet management objectives for a particular alternative. Because each alternative has different resource objectives, the mixture of management intensities is also different for each.

Full timber yields. (Management Area Prescriptions 314 and 411) These lands generally have high timber yields. The full range of silvicultural practices is available subject to being consistent with the standards and guidelines designed to provide multiple uses. These lands are generally managed using even-aged silvicultural systems. Rotation ages for managed stands occur near the culmination of mean annual increment (CMAI), a point where the average net merchantable growth (cubic foot basis) is at its maximum level. The age at which this occurs is dependent on the species, utilization standards, site productivity, stocking, and the management applied to the stand. For the hemlock-Sitka spruce cover types found in Prince William Sound and Copper River, the CMAI and rotation age for the average stand is estimated to be 160 years. For the hemlock and white spruce cover types on the Kenai Peninsula, the CMAI and rotation age for the average stand is 200 years.

Modified timber yields. (Management Area Prescriptions 312 and 321) These lands have special requirements to meet other resource objectives that result in reduced yields, by extending the conversion period. Suitable lands in these management areas have extended rotation ages of 200 years for the hemlock-Sitka spruce cover types found in Prince William Sound and Copper River and 250 years for the hemlock and white spruce cover types on the Kenai Peninsula.

Table 3-86 displays the acres of suitable timberlands by management area prescription for each alternative. Alternatives A, No Action and B have the largest acreage of suitable timberlands. Alternatives C, D, D, E, F, and the Preferred Alternative have no suitable timberlands.

Table 3-86: Acres of suitable timberlands (STL) in management area prescription category and prescription by alternative.

Management Area Prescription Category/Prescription	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Category 3 – 312	61,060	0	44,310	48,880	0	0	0	0
Category 3 – 314	0	0	12,540	3,130	0	0	0	0
Category 3 – 321	16,740	0	66,550	8,360	0	0	0	0
Total – Category 3	**77,800**	**0**	**123,400**	**60,370**	**0**	**0**	**0**	**0**
Category 4 – 411	0	0	25,740	0	0	0	0	0
Total – Category 4	**77,800**	**0**	**149,140**	**60,370**	**0**	**0**	**0**	**0**

Direct and Indirect Effects

General

The effects discussed below focus on acres actually harvested and the resulting forest products harvested from those areas. "Acres harvested" includes those acres in which trees were felled, yarded, and decked at landings.

Forest Products (Chargeable or ASQ) from Suitable Timberlands

Implementation of Alternative A would result in the most acres harvested and the greatest volume, followed by the No Action Alternative and B. Alterative A would harvest an average of 771 acres/year and would produce 16.3 million board feet/year (3.5 million cubic feet/year). The No Action Alternative would harvest 296 acres/year and produce 7.5 million board feet/year (1.6 million cubic feet/year). Alternative B would harvest 292 acres/year and produce 6.1 million board feet/year (1.3 million cubic feet/year). There would be no chargeable harvest effects in the Preferred Alternative and in Alternatives C, D, E and F. The chargeable volume in all three ASQ alternatives would be well above the projected annual demand of 1.1 to 1.8 million board feet per year.

Effects common to silvicultural harvest methods will be expected for the acres shown in Table 3-87 (see also FEIS, Appendix E). In all harvest alternatives, harvesting would be dominated by even-aged management system. Twenty percent of the acres harvested would be under an uneven-aged system. A primary objective when harvesting timber on suitable lands is to use silvicultural methods that favor and facilitate natural regeneration.

Table 3-87: Average acres per year harvested by silvicultural system - decade 1.

	Alternative							
Silvicultural Systems	**No Action**	**Preferred**	**A**	**B**	**C**	**D**	**E**	**F**
Even-Aged								
Clearcut	135	0	328	136	0	0	0	0
Seed Tree	0	0	0	0	0	0	0	0
Shelterwood	84	0	200	42	0	0	0	0
Coppice	0	0	0	0	0	0	0	0
Total Even-Aged	**219**	**0**	**528**	**178**	**0**	**0**	**0**	**0**
Uneven-aged								
Selection	0	0	0	0	0	0	0	0
Group Selection	74	0	154	58	0	0	0	0
Total Uneven-aged	**74**	**0**	**154**	**58**	**0**	**0**	**0**	**0**
Salvage	77	0	89	56	0	0	0	0
Sanitation	0	0	0	0	0	0	0	0
Total Salvage/Sanitation	**77**	**0**	**89**	**56**	**0**	**0**	**0**	**0**
Grand Total	**370**	**0**	**771**	**292**	**0**	**0**	**0**	**0**

A limited amount of thinning is planned for the three alternatives with an ASQ. Table 3-88 displays the estimated acres to be thinned by alternative. Some thinning is accomplished every year through the free and personal use forest

products program. Also, thinning may be prescribed where insect or disease damage is apparent in stand understories.

Table 3-88: Average acres per year of precommercial thinning - decade 1.

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Annual Pre-commercial Thinning	95	0	180	75	0	0	0	0

Forest Products (Nonchargeable) Timber Harvest on Unsuitable Forest Lands

In addition to commercial ASQ harvest in the No Action Alternative and Alternatives A, and B, vegetation management is planned on a portion of unsuitable forest lands in all alternatives to meet forest restoration, fuel reduction, wildlife habitat, insect and disease suppression, other resource objectives and to provide accessible forest products for the Forest's Alaska free use/personal use program. The acreage planned for treatment varies by alternative (see Table 2-11 in Chapter 2). The volume from this type of harvest is called "nonchargeable volume" because it was not included in the growth and yield projections to arrive at the ASQ.

Some of the planned treatments such as hazard tree removal in campgrounds, administrative sites, etc., would require tree removal that is expected to yield small annual quantities of nonchargeable sawtimber, cabin logs, fuel wood, posts, and poles. These nonchargeable forest product quantities would be available in a mix of sizes for commercial, Alaska free use and/or personal use, subject to demand, available access, and annual funding. In ASQ sale areas, some additional fuel wood would be available as a byproduct of those sales (this volume was not estimated).

Table 3-89 displays the decadal acres of vegetation management on unsuitable forestlands by alternative and the expected accessible non-chargeable timber volume that would be available for commercial, personal and free use.

Table 3-89: Acres of vegetation management on unsuitable timberlands with projected road accessible nonchargeable volume by alternative - decade 1.

Unsuitable Forest Land Timber Harvest	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Unsuitable Forest Land (Acres)	6,010	3,750	7,590	7,120	4,260	3,550	2,600	2,350
Nonchargeable Harvest (MMCF)	0.63	4.3	7.3	6.3	4.3	3.1	2.5	2.3
Nonchargeable Harvest (MMBF)	22.1	15.1	27.1	25.1	17.1	10.0	8.0	7.0

The availability of non-chargeable volume for commercial, personal, and free use is expected to be highest in Alternative A, followed by, in decreasing order, B, No Action, C, Preferred, D, E, and F. Alternative F would provide the least available volume. However, all alternatives would meet the estimated average annual demand for personal and free use forest products of 0.655 million board feet.

Volumes above the average demand would be available for commercial use and would rank the same as for total volume.

Where fuel wood harvests are a byproduct of ASQ sales, no further ground disturbance activity is anticipated. Where volume is the product of vegetation management on unsuitable lands, some slash accumulation and ground disturbance is anticipated. Adherence to Forestwide standards and guidelines is expected to result in no adverse effects.

Special Forest Products
The gathering of special forest products for commercial and personal uses is allowed in most management area prescriptions and is expected to continue under all alternatives. Ground disturbance from these activities is expected to be minimal. Requests for commercial special forest products permits would continue to be evaluated on a case-by-case basis, subject to management area prescription restrictions.

Effects on forest products production from recreation management.
All alternatives involve some hazard tree removal or insect and disease suppression in and around campgrounds, recreation cabins, and trail corridors on the Kenai Peninsula as part of forest restoration treatments. Forest product volumes derived from these activities have been estimated and are included in Table 3-89.

In Prince William Sound and Copper River where recreation impacts are concentrated (such as campgrounds, near trailheads, or heavily used dispersed sites), some existing trees would be damaged by cutting, scarring, and soil compaction. Treatments within developed sites also include the removal of hazard trees. In these circumstances, individual dead and/or dying trees may be cut. These individual trees are so scattered and infrequent and their volume so minimal that the volume has not been estimated.

Some construction/reconstruction of campgrounds, trails, and trailheads is expected in each of the alternatives. Trees would be cut and cleared but only enough to allow safe construction and effective use of these facilities. The forest product volumes derived from these activities are minimal and have not been estimated.

Effects on forest products production from fire management.
Fire history on the Kenai Peninsula indicates that numerous small fires and infrequent large ones have occurred. Fire suppression is assumed to be the same under all alternatives.

Wildland fires during the first decade may create the need for additional salvage and/or sanitation cutting. Volume estimates associated with potential fire salvage/sanitation have not been made.

Effects on forest products production from insects and disease.
Under all alternatives, endemic insect and disease infestations would be allowed to run their course resulting in relatively small timber volume loses. Depending on the severity of the infestation, effects on timber resources could vary widely.

Under all alternatives, the potential exists for salvage/sanitation cuts to harvest dead, dying, or damaged timber, and to slow or impede infestations from spreading. The degree to which these harvests are undertaken will largely depend on the risk associated with infestation into healthy stands, public safety, the presence of high valued resources, and the resource emphasis of the infested or adjoining area. Salvage of dead trees is still expected under all alternatives from both suitable and unsuitable land bases and volume estimates are already incorporated in the timber program volume.

Effects on forest products production from wildlife management.
Under all alternatives, prescribed fire would be the primary tool on the Kenai Peninsula used to improve early successional habitat on forestlands that are unsuitable for timber production. While prescribed fire would reduce the amount of timber available for forest products in the short-term, most of the acreage that would be burned would not be road accessible for commercial, personal, or free use.

Some salvage/sanitation opportunities for forest products might be available in burn units pre-felled to establish fuel continuity or in thinning, pest suppression, or mechanical treatments. Volume estimates for forest products salvage/ sanitation from wildlife treatments have not been made.

Cumulative Effects

The cumulative production of forest products that would result from a mix of management area prescription land allocations is displayed in Table 3-90.

Table 3-90: Timber sale program - decade 1.

Total Timber Sale Program	Unit of Measure	Alternative							
		No Action	Preferred	A	B	C	D	E	F
Total Demand for Commercial and Personal Use Timber	MMCF	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
	MMBF	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6
Timber Sale Program									
Chargeable	MMCF	16.0	0.0	34.6	12.9	0.0	0.0	0.0	0.0
Non-chargeable	MMCF	6.3	4.3	7.3	6.3	4.3	3.1	2.5	2.3
Total	**MMCF**	**22.3**	**4.3**	**41.9**	**19.2**	**4.3**	**3.1**	**2.5**	**2.3**
Chargeable	MMBF	74.9	0.0	162.9	61.1	0.0	0.0	0.0	0.0
Non-chargeable	MMBF	22.1	15.1	27.1	25.1	17.1	10.0	8.0	7.0
Total	**MMBF**	**97.0**	**15.1**	**190.0**	**86.2**	**17.1**	**10.0**	**8.0**	**7.0**
Chargeable	Acres	3,700	0	7,710	2,920	0	0	0	0
Non-chargeable	Acres	6,010	3,750	7,590	7,120	4,260	3,550	2,600	2,350
Total	**Acres**	**9,710**	**3,750**	**15,300**	**10,040**	**4,260**	**3,550**	**2,600**	**2,350**

Alternatives A, No Action and B all provide sale quantities above the estimated combined demand for chargeable and nonchargeable forest products while

alternatives Preferred, C, D, E and F provide sale quantities below the combined demand. Alternative F provides the smallest sale quantity.

Table 3-91 displays the annual reforestation program on both suitable and unsuitable forestlands that would be necessary to ensure that acres harvested to provide chargeable and nonchargeable forest products are reforested. Natural regeneration is expected to successfully restock about 75 percent of the harvested acreage. Planting is anticipated on the other 25 percent.

Table 3-91: Annual reforestation.

			Alternative							
Reforestation	Unit of Measure	Time Period	No Action	Preferred	A	B	C	D	E	F
Natural Regeneration	Acres	Annual	728	281	1148	753	319	266	195	176
Artificial Regeneration	Acres	Annual	243	94	383	251	106	89	65	59
Total Reforestation	**Acres**	**Annual**	**971**	**375**	**1531**	**1004**	**426**	**355**	**260**	**235**

Effects on other lands within or adjacent to the Chugach National Forest

Private lands. About 16,440 acres of private land are scattered within the boundaries of the Forest. It is not known how much of this land has been affected by timber harvest or is planned for future timber harvest. The cumulative effect of past, present and future timber management activities is estimated to be minimal.

Native corporation lands. About 412,740 acres of Native corporation land are located within the boundaries of the Forest. During the last 15 years, several thousand acres of Native corporation land has been harvested. Most of this harvest occurred in eastern Prince William Sound, Montague Island and east of Cordova. One small parcel was harvested on the Kenai Peninsula. The cumulative acreage harvested to date is unknown. Under the *Exxon Valdez* oil spill restoration (EVOS) land acquisition program, some of the Native corporation land that was harvested or planned for harvest has either been purchased or the right to harvest the timber was purchased for oil spill restoration. Recently, the Chugach Alaska Corporation has been granted a permit to build a road across National Forest System lands to its Carbon Mountain land for the expressed purpose of harvesting an estimated 8,000 acres sometime in the future.

State lands. About 382,250 acres of state land is located within the boundaries of the Forest. Some state land surrounding the communities of Moose Pass, Hope, Cooper Landing, and Seward has been or is planned for re-conveyance to the Kenai Peninsula Borough for community development. The State of Alaska has conducted some salvage harvest of spruce beetle killed timber around the communities of Moose Pass and Cooper Landing in the past. The total acreage harvested in estimated to be less than 1,000 acres.

Federal lands. The Bureau of Land Management manages one small block of public land within the Forest boundary and the U.S. Fish and Wildlife Service and National Park Service manage public land adjacent to the Forest boundary. The

cumulative effect from past, present and future timber management activities administered by these three federal agencies is minimal.

The total acreage harvested within the Forest since 1974 amounts to less than one percent of the forest land on the Chugach National Forest. Most of this harvest has been salvage harvest on the Kenai Peninsula. Generally, salvage harvest has left residual overstory trees of hemlock, hardwoods and uninfested white spruce.

The cumulative effect on the Forest's forested plant communities from implementing any of the alternatives in the planning period is estimated to be minimal in respect to the range of natural variability. Planned timber harvest in the No Action Alternative and Alternatives A, and B would mostly influence the hemlock-Sitka spruce cover types in Prince William Sound and the Copper River and the white spruce cover type on the Kenai Peninsula. Planned harvest in the Preferred Alternative and in Alternatives C, D, E, and F would have a minimal effect on the white spruce cover type on the Kenai Peninsula.

Minerals

Introduction

Geologic, geophysical, and geochemical investigations along with surveys of known mines, prospects, and mineral occurrences have been conducted to evaluate the mineral resource potential of the Chugach National Forest. The U.S. Geological Survey and the U.S. Bureau of Mines conducted these studies. Information from these studies was used to describe the mineral potential. Identified and potential resources include gold, copper, zinc, silver, lead, coal, oil, and possibly manganese, molybdenum, nickel, chromium, barium, cobalt, tungsten, and antimony. Significant amounts of gold and copper were produced on the Forest, in the past. Oil has been produced from the Katalla/Controller Bay area of the Forest.

While significant mineral production, mainly copper, lode gold and placer gold, has taken place on the Chugach National Forest in the past, current activities are generally limited to seasonal and part-time placer gold mining as well as gravel and rock extraction. Lode gold is not currently being produced, however there is some small-scale exploration ongoing at several historic mines. Copper has been extracted in the past, but is not being mined at present. There was some limited exploration for copper deposits on the Forest during the early to mid-1970s (Jansons et al 1984). More recently, on private (native) lands within the Chugach National Forest, there has been some evaluation of copper and other deposits (Kodosky and Teller 1989, Chugach Alaska Corporation 1999b). Presently copper deposits are being promoted for joint venture options by the landowners.

Increased use of gravel resources on the Chugach will be linked primarily to road construction activities, such as reconstruction of the Seward and Copper River Highways. Increased use of rock resources will depend heavily on harbor construction or improvements. Increased activity in placer mining, as well as for other minerals, will depend, in part, on the price of gold rising. Recreational gold panning and suction dredging for placer gold is having an impact on a limited portion of the Forest at the present time. Much of this activity is done by instate visitors, although an increase in tourism might cause an increase in recreational gold panning.

The Forest Service considers mineral exploration and development to be important parts of its management program. It cooperates with the Department of the Interior in administering exploration and development. While the Forest Service is mainly involved with surface resource management and protection, it recognizes that mineral exploration and development are ordinarily in the public interest and can be compatible in the long term, if not immediately, with the purposes for which national forests were established. National Forest System lands are generally available for mineral exploration and mining unless specifically precluded by an act of Congress or other withdrawal.

Legal and Administrative Framework

Policy toward mineral activities on National Forest System lands is guided by statutes and expressed in statements by the President of the United States, the Secretary of Agriculture, and the Secretary of Interior.

- The **General Mining Law of 1872** allows exploration, development and production of minerals from mining claims located on public lands. The Forest Service policy for mineral resource management, to "foster and encourage private enterprise in the development of economically sound and stable industries, and in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security, and environmental needs."
- The **Federal On-shore Oil and Gas Leasing Reform Act of 1987** gives the Forest Service authority to conduct a leasing analysis and decide which lands to authorize for leasing.
- **Alaska National Interest Lands Conservation Act of 1980 (ANILCA), Section 502** addresses mining and mineral leasing on certain national forest lands in Alaska. It withdrew the area of land known as the Copper River addition (approximately 801,600 acres) from location and entry under the General Mining Law of 1872. The “hardrock minerals” are available in the manner prescribed by Reorganization Plan Numbered 3 of 1946 and the Act of March 4, 1917.

Key Indicators

- Acres open to locatable mineral entry and mineral leasing
- Past and current mining claims
- Active mining operations
- Active mineral material sites
- Acres available for oil and gas leasing
- Reasonable foreseeable development for oil and gas production

Resource Protection Measures

Locatable Minerals

The locatable minerals regulations found at 36 CFR 228 Subpart A, requires the mining claimant to file a plan of operations (plan) or notice of intent (NOI) for proposed mining activities. The plan must include the name and address of operators, a sketch or map of the location, descriptions of operations, access, timing, operating period, and environmental protection measures. The Forest works with the operator to assure that standards and guidelines in the Revised Forest Plan are met. The plan requires an environmental analysis and decision before the plan is approved. A bond commensurate with the amount of

disturbance is generally required to guarantee reclamation work will be preformed. After plan approval, field monitoring is done to ensure compliance with the plan. Plans may be approved from one to five years. The length of time is mostly dependent on the scale of the operation.

Salable Minerals

The Forest Service regulations governing the disposal of saleable minerals (also called mineral material) are found in 36 CFR 228 Subpart C. These regulations require inclusion of reclamation measures in permits and contracts, except for disposals from common use or community pits. The Forest Service is responsible for reclamation of community sites and common-use areas. An environmental analysis and decision is required prior to offering a contract or permit. The operating plan must be responsive to the findings of the environmental analysis. Before operations begin under a permit or contract, a bond is generally required to ensure performance of payment and reclamation. Field monitoring is done to ensure compliance with the contract or permit.

Leasable Minerals

Leasing regulations are found at 36 CFR 228 Subpart E. The staged approach to oil and gas leasing, exploration, and development allows for analysis and mitigation of effects on other resources at each stage. The "leasing stage" level of analysis identifies effects on other resources from potential activities and specifies necessary restrictions (stipulations), if any, beyond those imposed by standard lease terms.

At the exploration and development stages, the Forest Service has the responsibility and authority to approve the Surface Use Plan of Operations (SUPO). Environmental analysis of the proposed project identifies effects on other resources from the proposed activity and specifies appropriate mitigation. Approved mitigation measures are included as conditions of approval. The Forest Service must approve the SUPO as part of the permit to drill (for which Bureau of Land Management (BLM) provides final approval of). Development activity proceeds only after the Forest Service and BLM have approved the development plan.

Forest Service and BLM personnel conduct periodic inspections of exploratory and development drilling operations and production activities to ensure compliance with mitigation measures and other applicable regulatory authorities.

Affected Environment

Statutory and regulatory direction separate mineral resources in lands owned by the United States into three broad categories: locatable (base and precious metals, such as gold, silver, and copper); leasable (oil, gas, and coal, as well as metallic minerals on acquired lands); and salable minerals or mineral materials (common variety sand, gravel, and stone).

Locatable Minerals

Locatable minerals are those mineral occurrences upon which mining claims can be located (mineral entry) under the General Mining Law of 1872, as amended. In general, the locatable minerals are those which are mined and processed for the recovery of metals, but may include certain nonmetallic minerals and uncommon varieties of mineral materials, such as valuable and distinctive deposits of limestone or silica.

On federally owned lands open to mineral entry, the public has the statutory right to explore for, locate mining claims and mine mineral deposits, subject to the U.S. mining laws. Through a memorandum of understanding with the BLM, the Forest Service administers most aspects of operation of U.S. mining laws on National Forest System lands.

Much of the Chugach National Forest System lands, approximately 4,601,800 acres, are open to entry under the General Mining Law of 1872. The mineral estate within the ANILCA Copper River addition (801,600 acres) to the Forest is withdrawn from operation of the mining laws, but is available under the hardrock or mineral leasing laws (ANILCA Sec. 502). Table 3-92 shows the status of the mineral estate on the Chugach National Forest.

Table 3-92: Status of the mineral estate within the Chugach National Forest boundary.

Mineral Estate Status	Acres
National Forest System Surface and Subsurface*	4,545,400
Acquired Lands	500
ANILCA Copper River Addition (acquired)	801,600
Katalla Oil Exchange Area	56,400
National Forest System Surface, Native Corporation Subsurface**	48,100
Private/State Surface and Subsurface	864,700
Total	**6,316,700**

* Includes 84,400 acres of fresh water lakes
** Includes EVOS lands

Past mineral production on the Forest has primarily been gold produced from placer and lode mines, as well as copper with associated base metals. The Analysis of the Management Situation (USDA Forest Service 1998b) contains published data regarding historic production and estimated reserves. Table 3-93 shows a summary of mineral production on the Chugach National Forest.

Table 3–93: Mineral production and reserves on the Chugach National Forest.

Deposit Type	Past Production	Current Production	Status	Reserves
Placer Gold	133,000 oz	Est. 700 oz/yr	Active suction-dredge operations	11,750,000 cubic yards[1]
Lode Gold	117,854 oz	0	Inactive	108,400 tons of ore[2]
Base Metal (Copper)	208,667,556 lbs	0	Inactive	>7,246,000 tons[3]
Coal	18,000 to 20,000 tons	0	Inactive	Est. varies from 36 million tons to >3.6 billion tons[4]
Petroleum	153,922 barrels	0	Four lease applications pending	None identified, Low potential
Sand, Gravel, and Stone	Unknown	Unknown	Active	Very large

[1] estimated cubic yards of gold bearing gravel
[2] estimated tons of gold bearing ore
[3] estimated tons of copper bearing ore, probably much larger with average grade of approximately 2% copper
[4] largest percent occurs on private land
Source: Jansons et al. 1984.

Mineral Potential

The U.S. Geological Survey revised the overall Forest mineral resource potential in March 1999. Their report summarizes and builds on previous geologic and mineral studies. It outlines mineral resource tracts that contain both identified and undiscovered mineral resources. The criteria used were: 1) geochemical anomalies, 2) favorable geologic units, 3) presences of mines, prospects of mineral occurrences, and 4) geophysical anomalies. Four deposit types were considered in ranking mineral resource tracts: 1) Cyprus-type massive sulfide, 2) Chugach-type lode gold, 3) placer gold, and 4) polymetallic vein deposits. The ranking was restricted to those types because they have had historic source potential for the area. Other deposit types were not ranked because they occurred in only one area, were incompletely studied, or were considered to have a low potential. The mineral resource tracts are classed as follows:

Identified Mineral Resources - Most Favorable Mineral Potential. A mineral resource potential is high where nearly all conditions are favorable for mineral deposit formation. In these areas, geologic, geophysical, geochemical, and other data demonstrate or suggest a high probability of mineral deposits. The size, grade, and location of known deposits are important supporting data in the assessment.

Identified Mineral Resources - Moderately Favorable Potential. A mineral resource potential is moderate where favorable geologic conditions have been identified or may reasonably be interpreted to

occur, but where substantiating evidence for mineral deposits is less clearcut.

Undiscovered Mineral Resources - Highly Favorable Mineral Potential. Tracts considered highly favorable for containing as yet, undiscovered deposits.

Under-evaluated, Unevaluatable Mineral Potential. These areas are considered under-evaluated with respect to their mineral potential due to rugged topography and glacial cover.

Low Mineral Potential. These areas (undesignated) lack geologic criteria indicating potential for resources or contain resources not addressed in the report, or contain deposits having a low probability of future development activity.

The mineral resource tracts acres for the Forest are displayed in Table 3-94.

Table 3-94: Mineral resource tract acres and percent of the Chugach National Forest. [1]

Mineral Resource Potential Tracts	Acres	Percent
Most Favorable - Identified	298,000	5
Moderately Favorable - Identified	1,005,000	15
Highly Favorable - Undiscovered	1,434,000	23
Under-evaluated	1,216,000	19
Undesignated	2,336,700	37
Total	**6,316,700**	**100**

[1] Includes private, state, and Native corporation mineral estate.

Five percent of the Forest is considered most favorable for mineral development to occur, based on the presence of known deposits. Some 23 percent of the Forest does not contain known deposits, has been poorly explored (due to rugged terrain and remoteness), and yet the geology is favorable for mineral deposits. These areas are considered highly favorable for the discovery of new deposits. Some 19 percent of the Forest is considered unevaluated and unevaluatable primarily because of the glacial cover as well as rugged terrain and remoteness. Lastly, 37 percent of the lands are classified as having a low potential for mineral occurrence. They lack geologic criteria indicating potential for resources or contain resources not addressed in the report, or contain deposits having a low probability of future development activity.

Current Situation

Recently (1994-1998) there were some 70 to 90 active plans of operations on the Forest. Most of those are for placer gold operations, with a few being lode gold exploration. The operations are generally active during the 3 to 4 month summer mining season. There are no plans of operations for copper or massive sulfides, on the Forest. The active operations are primarily small scale suction dredging. Some are hand placer operations using a shovel and sluice. Placer operations are producing less than 700 ounces/year. Nearly all of the active mining operations are occurring on the Kenai Peninsula primarily along the road corridor and on historically mined streams.

Potential Foreseeable Development

According to "Assessment of mineral resource tracts in the Chugach National Forest, by Nelson and Miller (under USGS contract) 2000:

> "Any production from either the inferred reserves or from as yet undiscovered deposits will be strongly dependent on metal values rising. Current feasibility evaluations suggest that production is unlikely for any of the lode deposits at current prices. Placer gold production, on a small scale is likely to continue in the more easily assessable areas that have had a previous history of placer activity."

Leasable Minerals

Federally owned leasable minerals include oil and gas, and coal. Metallic minerals on acquired lands and the Copper River addition (ANILCA, Sec. 502) are also leasable. These minerals are subject to exploration and development under leases, permits, or licenses granted by the Secretary of the Interior. The principal statutes are the Mineral Lands Leasing Act of 1920 as amended, the President's Reorganization Plan No. 3 of 1946, the Mineral Leasing Act for Acquired Lands of 1947, the Federal Coal Leasing Amendments Act of 1975, the Surface Mining Control and Reclamation Act of 1977, National Materials and Mineral Policy, Research and Development Act of 1980, and the Federal On-shore Oil and Gas Leasing Reform Act of 1987. The Secretary of the Interior's authority is administered by the BLM. When National Forest System lands are involved, the Forest Service has the authority and responsibility to determine which lands are available for leasing. The Forest Service is also responsible for prescribing lease terms that provide protection of the surface resources and values. The Secretary of the Interior has the authority to administer operations on National Forest System lands leased, licensed, or permitted. The Office of Surface Mining is responsible for coal, and the BLM is responsible for other minerals.

Potential for "Hardrock" Leasable Minerals

ANILCA (Copper River addition Sec. 502). Subject to valid existing rights, the minerals in public lands within the Copper River addition (approximately 801,600 acres) to the Chugach National Forest, are withdrawn from location, entry, and patent under the United States mining laws. With respect to such areas, the Secretary of Agriculture, under such reasonable regulations as deemed appropriate, may permit the removal of nonleasable minerals from the lands in the manner prescribed by Reorganization Plan Numbered 3 of 1946 and the Act of March 4, 1917 (39 Stat. 1150; 16 U.S.C. 520), and the removal of leasable minerals from such lands in accordance with the mineral leasing laws, if the Secretary finds that such disposition would not have significant adverse effects on the administration of the area.

The Act of March 4, 1917 (39 Stat. 1150; 16 U.S.C. 520) The Secretary of Agriculture is authorized to permit the prospecting, development, utilization of the mineral resources of the lands acquired under the Act of March 1, 1911.

Reorganization Plan Numbered 3 of 1946. The functions of the Secretary of Agriculture and Department of Agriculture with respect to the uses of mineral deposits in certain lands pursuant to the provisions of the Act of March 4, 1917, (39 Stat. 1134, 1150; 16 U.S.C. 520) "...are hereby transferred to the Secretary of the Interior and shall be performed by him or, subject to his direction and control, by such officers and agencies of the Department of the Interior as he may designate: Provided, that mineral development on such lands shall be authorized by the Secretary of the Interior only when he is advised by the Secretary of Agriculture that such development will not interfere with the primary purposes for which the land was acquired and only in accordance with such conditions as may be specified by the Secretary of Agriculture in order to protect such purposes."

Primary Purpose for Management (ANILCA Sec. 501(b)) The primary purpose of management for the Copper/Rude River addition and the Copper River-Bering River portion of the Chugach National Forest is the conservation of fish and wildlife and their habitat. The removal of nonleasable minerals may be permitted if the Secretary finds that such disposition would not have significant adverse effects on the administration of the area.

Current Situation

There are 298,000 acres of most favorable, 1,434,000 acres of undiscovered highly favorable mineral potential, 1,216,000 acres of under evaluated, unevaluatable mineral potential and 2,336,700 acres of low mineral potential. There are no current plans of operations and have been no application on record.

Potential Foreseeable Development

According to "Assessment of mineral resource tracts in the Chugach National Forest (Nelson and Miller 2000):

> "Any production from either the inferred reserves or from as yet undiscovered deposits will be strongly dependent on metal values rising. Current feasibility evaluations suggest that production is unlikely for any of the lode deposits at current prices. Placer gold production, on a small scale is likely to continue in the more easily assessable areas that have had a previous history of placer activity."

Potential for Oil and Gas

Most of the Forest (97.5 percent) has no potential for oil and gas (Bruns 1996, Plafker 1987). These areas do not need to be analyzed further or made available for leasing.

The Gulf of Alaska Tertiary Province was identified as a possible petroleum province (Miller et al. 1959). It borders the Gulf of Alaska from the Copper River Delta 300 miles southeastward to Icy Point and extends inland 2 to 40 miles to the southern front of the Chugach and St. Elias Mountains. The principle published sources of geologic information are reports on the Katalla (on the Forest) and the Yakataga (outside the Forest) Districts.

The USGS rates approximately 160,000 acres of an area, within the Gulf of Alaska Tertiary Province, on the East Copper River Delta (and including Katalla area) as having low potential for oil and gas. The presence of any major fields is unlikely because of the complex structure and the lack of suitable reservoir rocks (Nelson and Jansons 1984).

In the Katalla area, numerous oil and gas seeps onshore led to the discovery and development of the Katalla oil field. During a 30-year period, from 1904 to 1933, the Katalla field produced about 154,000 barrels from 18 wells in an area of about 60 acres. Production and refining operations provided products for local use.

Forty-four wells were drilled in the Katalla area, and another 23 wells were drilled along the coastal plain of the Gulf of Alaska, for a total of 67 onshore wells drilled in the Gulf of Alaska Tertiary Province. Except for the 18 producing wells in the Katalla field, none of the wells encountered producible hydrocarbons.

Three federal offshore lease sales have been held in the past in the Gulf of Alaska. Sale no. 39 was held in 1976, sale no. 55 was held in 1980 and a reoffering sale, RS-1, was held in 1981. Fourteen wells have been drilled offshore between 1969 and 1983. No producible hydrocarbons were discovered in any of these exploratory wells (Risley et al. 1992).

The offshore component of the Gulf of Alaska Tertiary Province appeared on the last 5-year plan (lease sale no. 158) of Minerals Management Service (MMS) but was never leased. It was dropped from the current 5-year plan (lease sale no. 179) due to lack of industry interest. Lease sale 179 (previously no. 158) was deferred to the next 5-year plan in 2000.

One hundred and sixty-four lease offers have been made for leases in the Eastern Copper River delta, and by 1987 all were closed. The Secretary of the Interior rejected all lease offers for leases inside the Favorable Petroleum Geological Province (FPGP) because Section 1008 of ANILCA provides that areas within the FPGP may only be leased through competitive bidding. The FPGP area is the same area as the Gulf of Alaska Tertiary Province. There were 48 offers for leases outside the FPGP in 1987. All have been withdrawn except for four, which have been pending since 1969. The BLM has attempted to locate the remaining applicants to request if they would like to withdraw their application and receive a refund, but has been unable to do so. The Forest does not consider the four remaining lease offers to constitute an expression of interest, since none of these lease applicants can be located. Additionally, all four offers are within an area of no potential for oil and gas. However, in order to resolve these pending applications the Forest must make a decision of whether or not the lands are availability for leasing.

Special Areas

The 1982 Chugach Native Inc. (CNI) Settlement Agreement gave the CNI (now the Chugach Alaska Corporation) rights to oil and gas in the "Katalla area," and an exchange preference for oil and gas rights in the "Katalla Exchange" area.

In the “Katalla area,” the settlement agreement gave CNI the exclusive right to drill for, extract, remove and dispose of all oil and gas deposits, as well as the right to construct all facilities and structures necessary to the full enjoyment thereof, for a period ending on December 31, 2004, and so long thereafter as oil and gas is produced in paying quantities. The United States reserves all other minerals. In addition, the United States reserves all authorities to regulate and prohibit any particular surface occupancies within the Katalla area, and permit public access where that use does not interfere with the rights of CNI. All operations by CNI must be conducted under a plan of operations approved by the United States and a special use permit (no fee) is required for entry for conducting oil and gas operations.

The “Katalla Exchange” area provisions are available to CNI for 25 years from the date of the agreement, and expire in 2008. In the event the Secretary makes a decision that the Katalla Exchange area should be made available for oil and gas production through the issuance of leases, then CNI shall have the first opportunity to acquire, by exchange, the rights to the oil and gas. An exchange may include interests in land greater than the oil and gas estate, including fee title. However, the United States is not obligated to open all or part of the Katalla Exchange area. From the time of notification of lease availability to CNI, then CNI shall have up to two years to negotiate and execute an exchange agreement, but that time shall not exceed 2008.

Current Situation

There have been no lease requests since 1987. Some seismic work has been done in recent years in the Katalla area. There are currently no producing wells on the Forest and no active leases. There are four lease applications pending (since 1969). When the Forest makes a decision on whether the lands are available for leasing, BLM can then resolve the lease applications. The interest in oil and gas on the Forest is considered low. At this time there is a proposal to drill on private lands in the Katalla area and future plans to drill directionally into the “Katalla Exchange” area.

Potential for Coal

Extensive coal deposits, known since 1896, occur in rocks in the Bering River area on the east side of the Forest. The area is classified as one of substantiated coal resource potential. Coal bearing rocks of the Kushtaka formation underlie about 10,000 acres of the Chugach National Forest and about 27,000 acres of Chugach Alaska Corporation lands. Only a minor amount of coal has been produced (18,000 - 20,000 tons), probably between 1910 and 1920.

A USGS report, “A Review of the Geology and Coal Resources of the Bering River Coal Field” (Barnes 1951), concluded that a large proportion of the coal exposures examined have been greatly disturbed, either by complex faulting or by crushing and shearing resulting from structural deformation. Since these conditions are typical of all parts of the field studied, the prospect of proving a large reserve tonnage of economically minable coal in a single block is not encouraging.

Areas of the Forest determined to be suitable for coal development would require site and project-specific environmental analysis prior to leasing and exploratory activity. Mitigation measures for protection of other resources and forest uses would be analyzed and specified at such time as a lease request is made.

Current Situation

There are no active coal mines or leases on the Forest. No coal production is occurring on the private lands in the Bering River Coal Fields. There is currently no development interest in the coal deposits.

Potential Foreseeable Development

Given the facts stated above concerning the oil and gas potential and the level of interest, it is unlikely that the Forest will see any significant oil and gas leasable activity in the near future. Likewise, development of coal resources seems unlikely. Coal has been known for many years, but has not been successfully mined to date. It is possible, if the road is built accessing the Bering River coalfields, that the discontinuous coal seams might be produced.

Salable Minerals

Salable minerals, also known as mineral materials or common variety minerals, are generally low-value deposits of sand, gravel, and stone that are used for building materials, erosion control, and road surfacing. Salable minerals are generally sold by competitive sale to the highest bidder. Community pits provide small sales to individuals, at a set price. Free use may be available to nonprofit associations, individuals, or government entities for use in public projects.

Extraction of these materials from National Forest System lands is at the discretion of the Forest Service. The major controlling statutes are the Mineral Materials Act of 1947 and Surface Resources Act of 1955. Requirements controlling mineral material operations are similar to those for leasable minerals.

There are two major areas of interest for mineral materials: the Kenai Peninsula/Seward Highway and the Cordova/Copper River Highway. Additionally the Forest has a rock and gravel source along the Alaska Railroad, Seward/Anchorage line, on the Kenai Peninsula. Prince William Sound area has tremendous potential for rock sources, although much of the area is a designated Wilderness Study Area.

In 1996, under an interagency agreement, a Mineral Materials survey was conducted by BLM along the Seward Highway road corridor. Twenty-seven sites were examined, consisting of current and previous materials pits as well as potential new sources. The report concluded that a majority of existing pits have been depleted or cannot be further expanded due to visual impacts or potential conflicts with other users. The quality of the mineral material available is generally low. Several existing pits can be expanded and there are new localities which hold potential for future development, particularly for borrow material. Several of the better material pits along the highway, were included in state land selections and have passed out of National Forest System ownership. This situation has prompted the investigation for new sources, as well as a careful

review when a request from the State Department of Transportation is made for mineral materials in the area. Free use permits may not be granted when the authorized officer determines the applicant owns or controls an adequate supply of mineral materials in the area of demand.

Current Situation

The Forest currently has four active community material pits, two (one for sand, and one for gravel) on the Seward District, one (gravel) on the Glacier District, and one (sand) on the Cordova District. There are two community rock sources on the Seward District. Currently about 30 materials permits are issued each year. Material is also used by the Forest Service for various projects, such as campgrounds, Forest roads, and trails.

The Spencer Glacier rock quarry was under permit from 1978 to 1997. It is ideally situated along the railroad and there is a demonstrated demand for the rock produced there. The rock is suitable for riprap for road and harbor projects. The quarry is currently not in operation because there is a mining claim issue to be resolved prior to offering the site for competitive bid.

All lands on the Chugach National Forest are open for permit application for salable minerals, with the exception of the Nellie Juan-College Fiord Wilderness Study Area and certain small withdrawn areas. Approval of permits is discretionary.

Potential Foreseeable Development

Mineral materials are expected to remain in demand and the Forest should be able to supply these materials as required for road construction and local uses. This may involve the opening and use of new pit sites. It is expected that the Spencer quarry will be back into production in the near future, again supplying rock for marine and road projects. The Copper River Delta sand source along the Copper River Highway can supply the local need for many years.

Environmental Consequences

General Effects – Locatable Minerals

The Revised Forest Plan does not affect the quantity or quality of locatable minerals, but it will affect the number of acres where mineral exploration and development are allowed. One of the most significant effects to locatable and “hardrock” leasable minerals operations is the withdrawal of lands from all forms of mineral entry. All withdrawals however, are subject to valid existing rights.

When a Record of Decision is issued for the selected alternative, the Forest Service may request that the BLM withdraw certain management areas from all forms of mineral entry. Some management areas will be withdrawn upon designation. The areas recommended for withdrawal and those that may be withdrawn upon designation are as follows:

131 - Recommended Wilderness

132 – Recommended Wild River

141 – Proposed Research Natural Area

142 - Natural Processes

241 - Municipal Watershed

341 - Developed Recreation Complex – Reduced Noise

441 - Developed Recreation Complex

522 - Transportation/Utility Systems

Additionally, developed campgrounds or other facilities may be withdrawn.

Currently within the Forest, there are lands that are not subject to the 1872 Mining Law as amended (Mining Law). These lands include *Exxon Valdez* oil spill (EVOS) lands, and the Copper River addition (CRA), as well as some small parcels. The lands not subject to the Mining Law involve 923,830 acres, which is 16.8 percent of the Chugach National Forest. The status of these lands does not vary by alternative. The CRA as well as several smaller acquired lands parcels, while not subject to the Mining Law, are subject to "hardrock" (gold, silver, copper etc.) leasing. This is explained in the "Leasable Minerals" section. The EVOS lands have generally had the mineral estate severed, and the Forest Service has only the surface estate; the subsurface estate is privately owned.

Table 3-95 displays, by alternative, the acreages in areas of different mineral potential (as identified in USGS Open-File Report 00-026, Nelson and Miller, 2000) that would be recommended for withdrawal. Table 3-95 also displays, by alternative, acreages of lands open to mineral entry.

The Preferred Alternative recommends about 30.4 percent of the Forest for withdrawal from all forms of mineral entry. Most of the recommended lands are not within the most favorable mineral resource tracts.

The least amount of land to be withdrawn is in Alternative A, where only .2 percent would either be recommended for withdrawal or withdrawn upon designation. The most land proposed for withdrawal would be in Alternative F at 80.9 percent. The current situation is 30.4 percent recommended for withdrawal.

There is a total of 298,000 acres of "most favorable" tracts for identified mineral resources. It is within these tracts that nearly all of the current level of mineral activity is taking place. The most restrictive alternative (F) would recommend 101,820 acres for withdrawal, leaving nearly 2/3 of the area open for mineral development.

Table 3-95: "Hardrock" minerals recommended for withdrawal and lands open to mineral entry.

	Alternative							
Mineral Potential	**No Action**	**Preferred**	**A**	**B**	**C**	**D**	**E**	**F**
IR[1] – Most Favorable	16,800	19,210	1,280	11,720	11,720	46,190	91,130	101,820
IR – Moderately Favorable	107,860	155,600	2,150	80,960	115,030	286,130	441,980	498,270
UR[2] – Most Favorable	348,420	339,260	140	122,780	241,310	386,400	446,890	940,830
UER-UE[3]	755,950	986,720	100	524,460	370,020	476,250	623,870	1,149,630
Low Potential	439,960	396,880	5,720	152,830	319,020	1,032,780	1,258,310	1,754,650
Total Acreage Recommended for withdrawal[4]	**1,668,990**	**1,897,670**	**9,390**	**892,750**	**1,057,100**	**2,227,750**	**2,862,180**	**4,445,200**
Percent recommended withdrawn	**30.4%**	**34.6%**	**0.2%**	**16.3%**	**19.2%**	**40.6%**	**52.1%**	**80.9%**
Total Acreage Open	**3,822,590**	**3,593,910**	**5,482,190**	**4,598,830**	**4,434,480**	**3,263,830**	**2,629,400**	**1,046,380**
Percent Open	**69.6%**	**65.4%**	**99.8%**	**83.7%**	**80.8%**	**59.4%**	**47.9%**	**19.1%**

[1] IR = identified resources
[2] UR = undiscovered resources
[3] UER-UE = under-evaluated, un-evaluatable
[4] Includes lands that would be withdrawn upon designation (i.e. Wilderness, Wild River, etc.)

Table 3-96 shows by percent, the availability in each alternative, of the most favorable identified mineral resource tracts and the highly favorable undiscovered mineral resource tracts. Mineral development is most likely to take place in the "most favorable, identified resources" tracts. Any new discoveries are most likely to be made in the "highly favorable, undiscovered resources" tracts. The mineral industry has indicated that those two tract types are the most significant.

Table 3-96: Percent available of most favorable resource tracts.

Mineral Resource Tracts	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Most Favorable, identified resources	94	93	100	96	96	85	70	66
Highly favorable, undiscovered resources	76	76	100	91	83	93	69	34

Direct and Indirect Effects

Management of other resources does not have any direct effects on physical mineral resources. Indirectly, development of public or private capital improvements could require localized withdrawals, but they would be minor in scope.

Cumulative Effects

An abandoned and inactive mine hazard inventory was done on the Forest from 1991 through 1994. There are a series of reports available at the Supervisor and Regional offices documenting the findings. Some 137 sites were field visited. Most of the hazards present are physical hazards; some chemical hazards exist. Nearly all of these sites were contaminated prior to the promulgation of Forest Service mining regulations (36 CFR 228). The Forest has begun the mitigation of these sites. Current regulations generally prevent new HAZMAT sites by required submission of an operating plan, reclamation and bonding requirements, and follow-up site monitoring.

A three-year study (1988-1990) was done to monitor what, if any, cumulative water quality impacts were occurring on the Forest streams from placer mining operations (Huber and Blanchet 1992). The results from water quality sampling did not indicate significant cumulative effects from placer mining operations. There is currently less active placer mining than was occurring during the study period. A new study will be initiated if the level of placer mining increases beyond that of the earlier study.

Locatable minerals activity is expected to continue in the same intensity as the past 10 years. Small-scale suction dredging occurring in the active stream channel, given timing restrictions for anadromous fish streams, is not expected to have any cumulative effects. Past water quality studies conducted on the Forest have determined that there are no cumulative effects to water quality from the small number, low frequency, and small scale of the suction dredging operations that occurs.

General Effects – Leasable Minerals

Oil and Gas – Geographic Zones 1 - 4

Alternatives in this EIS allocate certain lands, designated as Zones 1, 2, and 3 as available or unavailable, for oil and gas exploration and development. These three zones comprise 186,130 acres, which is three percent of the Forest, and overlies the Copper River - Bering River portion of the Forest. ANILCA, Title V mandates managing this area for the conservation of fish and wildlife and their habitat. Mineral leasing is allowed in so far as it does not have significant adverse effects on the administration of the area.

Zones 1, 2 and 3 were analyzed during this Forest planning effort. The environmental consequences are displayed within this EIS. Standard stipulations and site specific special stipulations as required would apply to oil and gas leases as well as the exercising by Chugach Alaska Corporation (CAC) of their Katalla Area oil and gas rights (1982 CNI Settlement Agreement). Zone 4 (5,315,320 acres) includes the remainder of the Forest and was determined to have no potential for oil and gas production (Plafker et al. 1978). Applications for oil and gas leases in Zone 4 would not be accepted without specific on-site environmental analysis.

Geographic Zone 1

The Katalla area (Zone 1) oil and gas rights as defined in the 1982 CNI Settlement Agreement is an area where CAC possesses a term interest in the oil and gas estate under specific conditions. In Zone 1, oil and gas could be developed under all alternatives, under conditions of the 1982 CNI Settlement Agreement. Zone 1 would not be subject to leasing to the public, but the process for the oil and gas development would be similar to a leasing situation. Upon expiration of CAC's oil and gas rights, the area would be managed according to the underlying prescription, and would be available for leasing in Alternatives A, B, and C; unavailable in the Preferred Alternative, and Alternatives D, E, and F. The 1984 Forest Plan (No Action Alternative) did not address this issue because it predated the Federal Onshore Oil and Gas Leasing Reform Act of 1987. In addition, there has been no expression of interest. The area has always been available as defined in the CNI Settlement Agreement.

Geographic Zone 2

The Katalla exchange area (Zone 2) as defined in the 1982 CNI Settlement Agreement, is subject to Chugach Alaska Corporation's exchange preference right. The exchange preference right is subject to expiration. Oil and gas development in Zone 2 will be implemented in accordance with the CNI Settlement Agreement, 1982. The 1984 Forest Plan (No Action Alternative) did not address this issue because it predated the Federal Onshore Oil and Gas Leasing Reform Act of 1987.

Geographic Zone 3

Zone 3 is an area identified as having low potential for oil and gas production and located outside of Zones 1 and 2. Zone 3 would be available for leasing under Alternatives A, B, and C and unavailable in the Preferred Alternative and

Alternatives D, E, and F. Table 3-97 displays the total acres available for oil and gas leasing by alternative. Zone 4 acreage is the same for all alternatives, because the area has no potential for oil and gas. The 1984 Forest Plan (No Action Alternative) did not address this issue because it predated the Federal Onshore Oil and Gas Leasing Reform Act of 1987.

Table 3-97: Zones available for oil and gas leasing and their total acreage.

	Alternatives							
	No Action	**Preferred**	**A**	**B**	**C**	**D**	**E**	**F**
Zone 1 (10,680 acres)	NA[1]	CAC only[2]	CAC only[3]	CAC only[3]	CAC only[3]	CAC only[2]	CAC only[2]	CAC only[2]
Zone 2 (56,360 acres)	NA[1]	Yes[4]	Yes	Yes	Yes	No	No	No
Zone 3 (119,090 acres)	NA[1]	No	Yes	Yes	Yes	No	No	No
Total acreage available, includes CAC oil & gas rights	**NA**[1]	**67,040**	**186,130**	**186,130**	**186,130**	**10,680**[5]	**10,680**[5]	**10,680**[5]
Area of potential/interest (Zones 1-3, acreage)	186,130	186,130	186,130	186,130	186,130	186,130	186,130	186,130
% potential/interest areas available	NA[1]	36%	100%	100%	100%	6%[6]	6%[6]	6%[6]

[1] The 1984 Forest Plan (No Action Alternative) did not address the issue because it predated the 1987 Oil and Gas Leasing Reform Act.
[2] The answer is "no" upon expiration of CAC's oil and gas rights.
[3] The answer is "yes" upon expiration of CAC's oil and gas rights.
[4] Oil and gas development in Zone 2 will be implemented in accordance with the CNI Settlement Agreement, 1982.
[5] Upon expiration of CAC's oil and gas rights, there would be zero acres available.
[6] Upon expiration of CAC's oil and gas rights, there would be zero percent available.

The reasonably foreseeable development for Zones 1, 2, and 3 was determined to be one exploration well, somewhere in one of the three zones within the next 10 years.

Stipulations were developed by an interdisciplinary team to protect areas that would not be adequately protected by the standard lease agreement. The stipulations are:

NSO – Available for oil/gas leasing with no surface occupancy;

CSU - Available for oil/gas leasing with controlled surface use;

CSU/TS - Available for oil/gas leasing with controlled surface use and timing restrictions;

TS - Available for oil/gas leasing with timing restrictions; and,

SS - Available for oil/gas leasing with standard stipulations.

Revised Forest Plan, Appendix I - Oil and Gas Leasing Stipulations, explains the justification and methodology of utilizing these stipulations.

For Zones 1-3, the leasing analysis in the Revised Plan process has met the requirements for a leasing analysis found in 36 CFR 228.102(c). Oil and gas

leasing supplemental stipulations have been identified and mapped on site-specific basis to a 40-acre level of accuracy. No new stipulations have been used.

Two leasing decisions are made in the Revised Forest Plan: the lands administratively available for leasing and the leasing decision for specific lands, 36 CFR 228.102(e) (subject to the verification process defined in the regulations).

Oil and gas leasing regulations 36 CFR 228.102(c)(2) require one of the alternatives analyzed to be that of not allowing leasing. The no leasing alternative for Zones 1 – 3 is reflected in Alternatives D, E, and F. However, Zone 1 would be subject to CAC's oil and gas rights until such time as these rights expire.

Oil and gas stipulations for the Preferred Alternative and Alternatives A – F were generated using a two-step process. The leasing stipulation was first identified based on protection of other resources. The leasing stipulation was then adjusted to reflect the standards of the management area prescription allocation for each alternative.

Table 3-98 displays the acres (and miles of stream fish habitat) by stipulation for Zones 1-3 for each alternative. The table addresses requirements in: regulations found at 36 CFR 228.102(1)(i) which directs identifying areas open to leasing subject to standard lease terms and 36 CFR 228.102(1)(ii) which directs that the leasing analysis indicate lands open to development but subject to constraints that will require the use of lease stipulations such as those prohibiting surface use on areas larger than 40 acres. Maps are available in the planning record, located at the Forest Supervisor's Office, in Anchorage, Alaska.

Table 3-98: Oil and gas leasing stipulations for Zones 1 - 3 (units in acres or miles).

	Alternative							
	No Action	Preferred	A	B	C	D	E	F
Availability	NA[1]	Zones 1,2	Zones 1,2,3	Zones 1,2,3	Zones 1,2,3	Zone 1	Zone 1	Zone 1
Standard Terms (all available acres)	NA[1]	67,040[1]	186,130	186,130	186,130	10,680[2]	10,680[2]	10,680[2]
NSO - Wild & Scenic Rivers	NA[1]	5,780	18,790	18,790	18,790	760	760	760
NSO – Soils/Slope	NA[1]	0	7,600	7,600	7,600	0	0	0
CSU – Soils/Slope	NA[1]	66,700	167,100	167,100	167,100	10,680	10,680	10,680
CSU (BMPs) – Fish[3] (miles of stream)	NA[1]	41.5	113.9	113.9	113.9	3.7	3.7	3.7
CSU/timing – Wildlife[3]	NA[1]	134,700	403,600	403,600	403,600	17,500	17,500	17,500
Timing – Wildlife[4]	NA[1]	111,700	361,500	361,500	361,500	17,200	17,200	17,200

[1] The 1984 Forest Plan (No Action Alternative) did not address the issue because it predated the 1987 Oil and Gas Leasing Reform Act.
[2] If CAC's oil and gas rights (and under the Preferred, exchange preference right) expire then the figure would be 0, because the lands would not be available.
[3] This is the only category that uses miles rather than acres.
[4] Acres may exceed total available because acres were totaled by species and there is overlap.

Preferred Alternative Zones 1 – 2 are available for oil and gas development under the 1982 CNI Settlement Agreement. Zone 3 is not available for oil and gas development.

No Action Alternative Zone 1 could be developed for oil and gas under the 1982 CNI Settlement Agreement. A site-specific environmental analysis would be conducted and stipulations developed, in response to an operating plan submittal. No leasing availability decision was made in the 1984 Forest Plan because it predated the 1987 Federal Onshore Oil and Gas Leasing Reform Act. Leasing could have occurred on a case-by-case basis following site-specific analysis.

Alternatives A – C Zones 1 – 3 are available for oil and gas development (leasing on Zones 2-3). Zone 1 is available for oil and gas development and would be available for leasing upon expiration of CAC's oil and gas rights.

Alternatives D – F Zones 1 – 3 are not available for leasing. However Oil and gas in Zone 1 may be developed under the terms of the 1982 CNI Settlement Agreement, until such time as CAC's oil and gas rights expire. The oil and gas rights would be valid existing rights within Recommended Wilderness.

The stipulations (Revised Forest Plan, Appendix I) would be the same for all alternatives, which allow leasing. An exception is for oil and gas development in Alternatives D, E, F, which all place Recommended Wilderness over Zone 1. CSU stipulations would apply to the entire area of Zone 1, in order to protect the wilderness character, while still allowing oil and gas development.

No Surface Occupancy (NSO) is the most restrictive lease stipulation. NSO would apply to:

- eligible/recommended wild river corridors;
- eligible/recommended scenic river corridors;
- glaciers and ice fields; and,
- slopes over 75 percent.

Because Zones 1-3 have a low potential for oil and gas development, any environmental effects would be small given the low level of expected activity.

Oil and Gas – Geographic Zone 4
The remainder of the Forest, geographic Zone 4, has no potential for oil and gas. Leasing may occur on a case-by-case basis following site-specific analysis. Some of these lands are not subject to mineral leasing, such as campgrounds and the Wilderness Study Area.

"Hardrock" Leasables
"Hardrock" (gold, silver, copper, etc.) minerals, normally termed locatable minerals, become leasable on certain acquired lands. The Copper River addition (CRA), comprised of 801,600 acres, is a large parcel of acquired status land that although not subject to the U.S. Mining Laws, may make available the "hardrock" minerals through the leasing process. The CRA west of the Copper River lies within an area that has been identified as having a high potential for undiscovered resources. The CRA, east of the Copper River, lies within an area that has been determined to be under-evaluated and not evaluatable for mineral resources due to glaciers, ice fields and rugged topography. ANILCA Title V mandates that CRA be managed primarily for the conservation of fish and wildlife and their habitat. Mineral leasing of (normally) non-leasable minerals (hardrock minerals) may be permitted if the Secretary determines that such disposition would not have significant adverse effects on the administration of the area.

If a proposal to lease land within the CRA is submitted, a site-specific environmental analysis would be done to determine environmental effects from the proposed activity, and identify mitigation measures. The Forest Service would then prepare a decision document identifying the Forest Service position, either denial or consent.

The No Action Alternative and Alternatives A and B permit hardrock leasing in the CRA to the extent that such disposition would not have significant adverse effects on the administration of the area.

The Preferred Alternative, and Alternatives C, D, E, and F, place Recommended Wilderness over the portion of the CRA that lies east of the Copper River. The development of hardrock minerals would not be allowed. The eastern portion of the CRA has been determined to be of limited value for mineral development because of the glaciers, ice fields and rugged topography. Lands in the western portion of the CRA would be subject to hardrock leasing to the extent that such disposition would not have significant adverse effects on the administration of the

area. Lands west of the Copper River are considered to be favorable for undiscovered mineral resources.

Alternatives E and F place Recommended Wilderness over all CRA lands. The development of hardrock minerals would not be allowed. Lands west of the Copper River are considered to be favorable for undiscovered mineral resources. Lands east of the Copper River have been determined to be of limited value for mineral development because of the glaciers, ice fields and rugged topography.

Given the remoteness, lack of access, lack of known deposits, and the lack of any proposed mineral activity in the area over the last 10 years, it is unlikely that any leases will be applied for within the next 10 years, therefore no environmental effects would be expected to occur from hardrock leasing.

Cumulative Effects

Oil and gas leases have numerous environmental requirements to comply with applicable law and regulations. To minimize effects to other resources, lease stipulations are applied to oil and gas development. The lease stipulations are described in Appendix I of the Revised Forest Plan. When leasing restrictions are combined, oil and gas development is adversely affected. Under no surface occupancy restrictions, drilling cost would increase because of directional drilling requirements. Seasonal restrictions under timing stipulations could result in access time being too short for effective exploration and development programs. Controlled surface use stipulations also could increase the cost of exploration and drilling. The cumulative effect of lease restrictions could hinder or prevent oil and gas development in certain locations within the Forest.

General Effects – Mineral Materials

Common variety minerals may be sold for fair market value or disposed of through free use in any of the proposed alternatives. This category of minerals is widely available across the Forest. Some prescriptions would not allow the extraction of mineral materials. None of the alternatives would result in significantly affecting the supply since there are large volumes of common variety minerals on private and state lands that could meet the public needs.

One important source of riprap and armor stone on the Forest, the 600-acre Spencer Glacier Mineral Materials Site, would be available under all alternatives. This source is significant because of its location along the railroad, large volume of material available, being a developed quarry, and containing a type of material that is in demand. The Spencer Glacier site lands were withdrawn from mineral entry under the U.S. Mining Law, for the specific purpose of a mineral materials source. In the Preferred Alternative and Alternatives C and D, there could be a developed recreational complex (about 50 acres) at Spencer Glacier. Although the complex and quarry could co-exist side-by-side physically, there would likely be conflicts because the quarry would be considered to be a visual impact to the glacier scene and the natural quiet would be disrupted in the vicinity by blasting and heavy equipment operating at the quarry.

Social and Economic Elements

Social and Economic

Social and Economic

Introduction

Social and economic analysis is conducted by the Forest Service to determine what effects the agency's land management programs have on local communities and the people using the natural resources of the Forest. People using the Chugach National Forest are part of the ecosystem and have an important role in management decisions.

Legal and Administrative Framework

- The **National Environmental Policy Act of 1969 (NEPA) -** NEPA requires the integrated use of natural and social sciences, and the disclosure of the effects on the human environment.
- The **National Forest Management Act of 1976 (NFMA) -** NFMA requires the integration of social science knowledge into the Forest planning process, and the consideration of economic benefits and costs.

Affected Environment

In this section we describe economic and social aspects of the Forest and its surroundings that are relevant to the planning decision. An understanding of the general social and economic environment of Southcentral Alaska is essential in gauging the potential impact of planning decisions on local residents. Accordingly, the first section of this analysis provides a regional overview of social and economic conditions within the three boroughs/census areas surrounding the forest (the Municipality of Anchorage, the Kenai Peninsula Borough, and the Valdez-Cordova Census Area). There are numerous ways in which planning decisions may affect local residents, and the most obvious of these are the direct linkages through forest resource dependent activities such as timber harvest, commercial salmon fishing, and recreation activity. Following the regional overview, we concentrate on these activities and the industries they support.

Borough level statistics often miss important aspects of smaller settlements, and the next section of this analysis provides information specific to communities. Fifteen communities are considered: Anchorage, Chenega Bay, Cooper Landing, Cordova, Eyak, Girdwood, Hope, Kenai, Moose Pass, Seward, Soldotna, Sterling, Tatitlek, Valdez, and Whittier. The opinions of potentially affected residents are an important consideration in the planning decision, and the last section of the affected environment analysis presents findings from two opinion surveys conducted as part of the planning process. These surveys were designed to gain a better understanding of the ways in which communities perceived themselves, their views regarding the management of the Chugach National Forest and other public lands, and the role these lands play in helping to determine the quality of life for local residents. Much of the social and economic information presented here is drawn directly from a Social and Economic

Assessment that was conducted for the revision, and interested readers can see that report for a more detailed analysis (Crone et al. 2000).

We will refer to the three borough/census areas collectively as the study area or Southcentral Alaska, interchangeably. There are two additional boroughs, the Matanuska-Susitna (Mat-Su) Borough and the Kodiak Island Borough, which border and contain portions of the Forest but are not included in the following analysis. Communities within 100 miles of national forest lands are commonly considered to be within the study area in forest planning exercises. The communities within Mat-Su and Kodiak Island boroughs meet this criterion, and they may continue to qualify for community assistance programs sponsored by the Forest Service's State and Private Forestry division. Due to their geographical boundaries and limited access to forest resources, however, these communities are not likely to be significantly affected by economic and social impacts resulting from management decisions on the Chugach National Forest.

The Mat-Su Borough contains about 43,400 acres or 0.81 percent of the Forest, which is mostly rock and ice and is largely inaccessible. Kodiak Island Borough contains about 1,920 acres, or 0.04 percent of the Forest, located on Afognak Island. While these areas do not have significant forest resources or access by local communities, the Forest pays each borough a portion of total revenues based on Forest acreage within the borough boundaries. In 1998, the Mat-Su Borough received $375 in payments, and the Kodiak Island Borough received $168. These payments were respectively 1.1 percent and 0.5 percent of total payments from the Chugach National Forest to boroughs in the State of Alaska (USDA Forest Service 1999e).

Regional Overview

The following summary provides a description of current conditions and recent trends in social and economic environment in the planning area. The people living within the area, outside the area, and those making management decisions about the resources of the Forest should understand the social and economic context of the area most likely to be affected (positively or negatively) by these resource decisions. For a more comprehensive look at the social and economic information summarized here, readers are referred to the Social and Economic Assessment (Crone et al. 2000).

Demographics

With about 0.23 percent of the United States population and 16 percent of the country's total land base, Alaska is the Nation's largest state, but has the third smallest population base and the lowest population density. The Municipality of Anchorage, with slightly less than half of the state's total population, is the largest population center in Alaska. It is characterized by an urban economy and lifestyle which is quite different from the small and often isolated communities that are found on the Kenai Peninsula Borough and, especially, in the Valdez-Cordova Census Area. When looking at economic and social information for the study area as a whole, local conditions in these smaller places are overwhelmed by the size of the Municipality of Anchorage. In terms of numbers of potentially

impacted individuals, the Municipality of Anchorage is dominant, but impacts of planning decisions on people in rural areas are likely to be much more profound. For this reason, it is important to examine conditions and identify trends for each of the three areas individually.

Table 3-99 summarizes selected demographic statistics for the United States, Alaska, and the three Forest areas for 1990 and 1998. In terms of total population and population density, the Municipality of Anchorage and the Valdez-Cordova Census Area stand at opposite ends of the spectrum between urban and rural settlement patterns. The Kenai Peninsula Borough is somewhere between the situations presented by the Municipality of Anchorage and the Valdez-Cordova Census Area. The Valdez-Cordova Census Area has a higher proportion of Native American residents, reflecting, in part, the presence of several Native villages in the Census Area. Another point to notice in Table 3-99 is that all three areas display an increasing median age, a trend that is reflected in the statistics for the nation as a whole but which is especially pronounced in the case of the Kenai Peninsula Borough and the Valdez-Cordova Census Area. This aging of the population has important implications for understanding certain economic changes occurring in the study area.

Table 3-99: Population characteristics compared for the United States, Alaska, and Southcentral Alaska in 1990 and 1998.

Variable	United States		Alaska		Municipality of Anchorage		Kenai Peninsula Borough		Valdez-Cordova Census Area	
	1990	1998	1990	1998	1990	1998	1990	1998	1990	1998
Population	248,709,873	270,028,937	550,043	621,400	226,338	258,782	40,802	48,815	9,952	10,365
Percent of the State (%)	---	---	100	100	41	43	7	8	2	2
Caucasian (%)	84	83	76	74	82	78	91	90	83	81
Native American (%)	1	1	16	17	7	8	7	7	13	14
African American (%)	12	13	4	4	7	7	1	1	1	1
Asian-Pacific Islander (%)	3	4	4	5	5	7	1	2	3	4
Hispanic Origin, any race (%)	9	11	3	5	4	7	2	3	3	2
Persons per square mile	70.3	76.4	1.0	1.1	133.3	152.4	2.5	3	0.3	0.3
Persons per household	2.6	2.6	2.8	2.7	2.7	2.6	2.8	2.6	2.7	2.6
Median Age	32.8	34.9	29.2	32.4	29.6	32.1	31	35.4	31.8	36.6
Males to 100 females	95	96	111	108	106	105	112	109	122	115
Education, persons 25 or older										
High school degree or higher	75.2	82.8	86.6	NA	90.4	NA	87.2	NA	83.9	NA
Bachelors degree or higher	20.3	24.4	23	NA	26.9	NA	17.9	NA	18.5	NA

NA = not available.

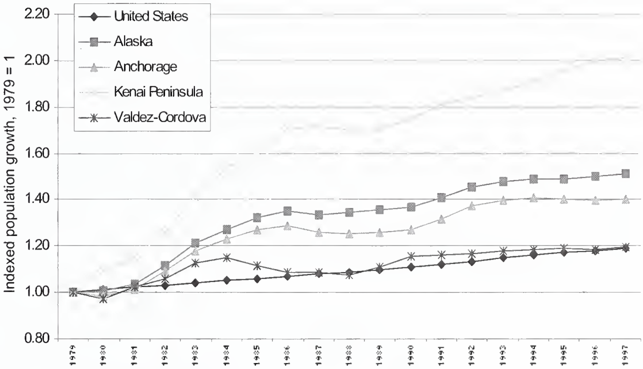
--- = not applicable.

Sources: Alaska Department of Labor, Research and Analysis 1999; U.S. Department of Commerce, Bureau of the Census 1990; U.S. Bureau of Economic Analysis 1999.

Figure 3-79 displays trends in resident population growth for 1979-97, indexed to 1979. The use of an index allows for comparisons of changes between areas on a relative scale rather than in absolute levels. The Kenai Peninsula Borough demonstrates an extremely rapid growth rate, estimated at 3.4 percent average growth per year, as compared to 1.9 percent for the Municipality of Anchorage

and 0.9 percent for Valdez-Cordova Census Area. The result is that the Kenai Peninsula Borough's population has doubled over the last twenty years. (Note, however, that if 1986 was chosen as a reference year, estimated population growth for the Kenai Peninsula Borough would be significantly less). While less than the Kenai Peninsula Borough, the Municipality of Anchorage's growth rate is nearly double that of the nation as a whole, resulting in a population level half again as large as it was in 1979. In absolute terms, the Municipality of Anchorage's population has increased by around 77 thousand residents as compared to 25 thousand for the Kenai Peninsula Borough and 1.5 thousand for the Valdez-Cordova Census Area. This population growth brings with it significant changes in both the magnitude and types of demands local residents place upon the Forest, and, once again, it highlights the differences between the three different regions encompassed by the study area.

Figure 3-79: Population growth, 1979-1997, indexed to 1979.

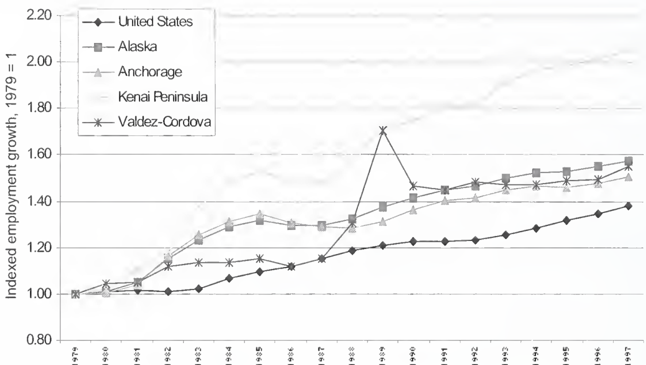


Source: U.S. Bureau of Economic Analysis 1999.

Employment

All employment estimates used in this portion of the document refer to average annual employment. Here, one employment unit is equivalent to 12 months of full *or* part-time work. Total employment growth in Municipality of Anchorage is equal to that of the nation, and growth in the Valdez-Cordova Census Area and, especially, the Kenai Peninsula Borough exceeds the national average by a significant amount (Figure 3-80). Boom and bust cycles are much more pronounced in the study area, especially in the Kenai Peninsula Borough and the Valdez-Cordova Census Area. This is not uncommon in less populated areas, as the smaller size of the local economy tends to result in greater instability (note the impact of the 1989 *Exxon Valdez* oil spill on employment in Valdez-Cordova Census Area).

Figure 3-80: Total employment trends, 1979-1997, indexed to 1979.



Source: U.S. Bureau of Economic Analysis 1999.

Long-term trends in employment are usually directly related to trends in population, and the relative magnitude of employment growth rates shown in Figure 3-80 closely match those shown for population (Figure 3-79). One important difference is that growth rates for employment are uniformly higher than those for population, and this is particularly true for the Valdez-Cordova Census Area where employment levels have increased by close to 60 percent over the 1979-97 period while population has increased by only about 20 percent. Either an increase in work-force participation, an increase in part-time employment, or both explains this trend.

Along with the growth in total employment levels have come significant changes in the mix of employment between different industry sectors. Table 3-100 displays current shares and average annual growth in employment by major sector for 1998, comparing the United States, Alaska and Southcentral Alaska. The distribution of employment by industry sector in Alaska shows some

significant differences from that of the United States as a whole. The agriculture-forestry-fishing (A.F.F.) sector percentage is relatively higher in Alaska as a whole and in Southcentral Alaska. This is due to the importance of commercial fishing in the state and region. The mining sector, which includes all hard rock mining as well as oil and gas operations, and the transportation, public utilities and communications (T.P.U.C.) sector, each comprise a larger percentage of employment in Alaska and Southcentral Alaska than in the United States. The largest difference in employment distribution, however, is in the government sector, which includes all local, state and federal employment. Alaska has 10 percent more of its total non-farm employment in this sector than the nation as a whole. This is a partial result of the military installations present in Alaska, but it is also a common characteristic of the sort of sparsely populated "frontier" regions that Alaska epitomizes.

As with the nation as a whole, most of the total growth in employment has been concentrated in the retail and service sectors, where, owing to their size, growth will have a relatively large absolute effect as compared to growth in smaller sectors. An expansion in recreation and tourism has commonly been cited as a major factor underlying this growth, but it should be noted that health care is the single largest component of the services sector in all three boroughs, and that growth in this category has likewise been considerably higher than in service sector as a whole (U.S. Bureau of Census, County Business Patterns 1999 and previous). This trend also follows national trends and is directly linked to the rising median age noted in the previous section on demographics.

Table 3-100: 1998 Employment shares and average annual growth by industry, for the United States, Alaska, and Southcentral Alaska.

Nonfarm Employment by Sector[a]	United States		Alaska		Municipality of Anchorage		Kenai Peninsula Borough		Valdez-Cordova Census Area	
	Share	Growth[b]	Share	Growth[b]	Share	Growth[b]	Share	Growth[b]	Share	Growth[b]
A.F.F.	1.3	4.7	3.6	2.1	1.3	2.5	8.5	1.0	9.2	2.5
Mining	0.5	-2.9	3.0	2.2	2.6	2.5	4.6	2.2	1.0	4.8
Construction	5.6	2.3	5.2	0.2	5.4	0.1	6.6	2.1	6.5	0.1
Manufacturing	12.5	-0.4	4.4	2.3	1.6	1.1	7.7	1.8	8.7	4.6
T.P.U.C.	4.9	1.7	7.8	2.7	8.6	3.2	6.0	3.4	15.1	2.4
Wholesale trade	4.7	1.3	2.7	2.2	4.0	1.9	2.2	3.8	1.7	1.9
Retail trade	17.0	2.3	15.8	3.9	16.9	3.2	17.9	6.7	11.6	3.6
F.I.R.E.	7.8	1.7	5.9	-0.3	7.6	-1.2	4.7	0.0	3.7	1.3
Services	31.8	3.9	27.2	4.8	30.1	4.1	24.5	7.0	23.4	4.4
Government	14.0	1.1	24.2	0.9	21.9	0.7	17.3	4.6	19.1	0.5
Total (1,000 employees)	**157,072**	**2.0**	**384**	**2.4**	**176**	**2.0**	**27**	**3.9**	**7**	**2.5**

(D)= not available due to disclosure rules.

[a] Sectors defined according to Standard Industry Classification Manual, 1987:

A.F.F. (Agricultural, forestry, and fishing services) includes businesses engaged in agricultural production, forestry, commercial fishing, hunting and trapping, and related services.

Mining includes the extraction of minerals occurring naturally, quarrying, well operations, milling, preparation at the mine site, and exploration and development of mineral properties.

Construction includes new work, additions, alterations, reconstruction, installations, and repairs of structures.

Total manufacturing includes the processing of materials (products of agriculture, forestry fishing, mining, and quarrying) into new products. Examples include food, textiles, lumber, wood products, furniture, paper, machinery, and appliances.

Retail trade includes selling goods for personal or household consumption and rendering services incidental to the sale of the goods. Examples include groceries, hardware, drug store, and other specialty stores.

Wholesale trade includes selling goods to retailers or other wholesalers. Wholesalers maintain inventories of goods, extend credit; physically assemble, sort, and grade goods in large lots, break bulk goods into smaller lots and advertise.

F.I.R.E. (Finance, insurance, and real estate) includes business that operate in the fields of finance, insurance, and real estate, such as banks, investment companies, insurance agents and brokers; real estate buyers, sellers, and developers.

Services include businesses engaged in providing a wide variety of services for individuals, business, government, and other organizations. Examples include hotels; health, legal, engineering, and professional services; and educational institutions.

T.P.U.C. (Transportation, public utilities and communications) includes passenger and freight transportation, communications services, electricity, gas, steam, water and sanitary services and all establishments of the United States Postal Service.

Government includes all federal, state, and local government employees involved in executive, legislative, judicial, administrative and regulatory activities.

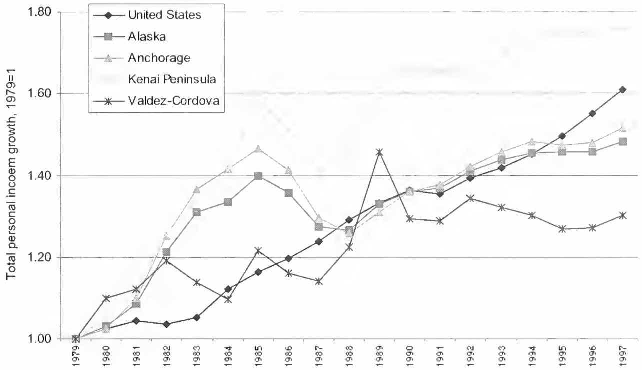
[b] 1979-98 average annual growth in percent.

Source: U.S. Bureau of Economic Analysis 2000.

Personal Income

While employment statistics help us understand overall growth in economic activity and the job opportunities this growth creates, personal income statistics more directly measure the economic benefits residents receive. Personal income can be divided into two main categories. Earned income, the first category, includes all wage and salary earnings (including wages paid by self-proprietors to themselves). The second category, unearned income, includes all government transfer payments to individuals (social security, for example) and income from property or other investments. Capital gains, however, are not included.

Figure 3-81: Total personal income trends, 1979-1997, for the United States, Alaska, and Southcentral Alaska – in 1999 dollars, indexed to 1979.



Source: U.S. Bureau of Economic Analysis 1999, Economic Report to the President 2000.

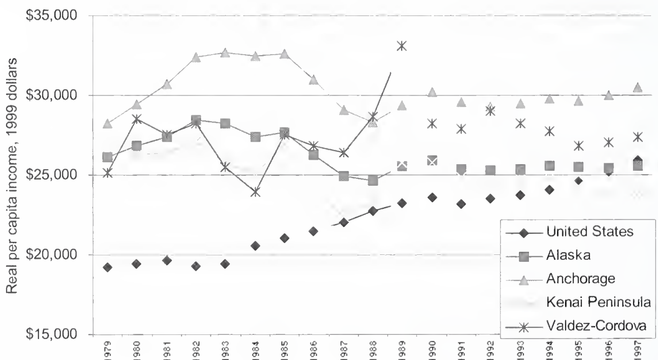
Personal income in Alaska fluctuated more than the fairly steady growth in United States personal income. A peak occurred in the mid-1980s when the state spent oil revenues on infrastructure throughout Alaska. When oil prices dropped in the late 1980s, state personal income fell as well. Recovering in the early 1990s, Alaska's total personal income has seen fairly stable growth into the present. Personal income in the Municipality of Anchorage and the Kenai Peninsula Borough has roughly followed the same trends as the state, although it has grown proportionately faster in the Kenai Peninsula Borough.

The Valdez-Cordova Census Area is not in line with the other areas or with the state trends. The area shows more volatility in personal income through the early 1990s with the spike in 1989 associated with clean-up efforts related to the *Exxon Valdez* oil spill. Personal income increased after the spill, but has declined again in recent years. The higher volatility in income is likely a partial result of the smaller absolute size of economic activity in the Valdez-Cordova

Census Area, and recent declines in income may be a result of stronger ties to traditional resource extraction industries.

Per capita personal income is a measure that includes trends in population and total personal income. This measure is often used as an indicator of economic well being in an area. In the past, people from the lower 48 have been enticed to come and work in Alaska by the promise of higher wages and a higher standard of living. Over the years, the difference between average incomes in the United States and income in Alaska has decreased, although some areas maintain a larger gap. Figure 3-82 displays trends in per capita income for the United States, Alaska, and Southcentral Alaska from 1979-1997. These values have been adjusted for inflation, so the values of each year are comparable in 1999 dollars. It is easy to see the closing gap between Alaska per capita income and the United States per capita income. The United States displays an increasing trend, while Alaska fluctuates more with overall economic trends. More recently the per capita incomes at the state level and in Anchorage have remained fairly stable while the Valdez-Cordova Census Area and the Kenai Peninsula Borough have had slightly declining per capita income levels.

Figure 3-82: Indexed per capita income for the United States, Alaska, and Southcentral Alaska, 1979-1997 in 1999 dollars.



Source: U.S. Bureau of Economic Analysis 1999, Economic Report to the President 2000.

Table 3-101a displays 1998 levels and growth rates for real per capita personal income as well as its earned and unearned categories. This is simply total personal income divided by the 1998 population and then adjusted for inflation. Several striking facts are apparent from the table. First and foremost is that per capita incomes have been stagnant or declining in the study area. This can be compared to a 1.5 percent average annual growth rate for the nation as a whole. The reason for this is a marked decline in earned income, once again in contrast to the national average. While falling per capita incomes are certainly a cause for concern, it is important to remember that this has occurred in areas with relatively high rates of population and job growth and that current per capita income in the study area is still roughly equivalent to that of the United States in spite of depressed growth rates. Though this latter fact may be of small consolation to consumers facing the higher prices that are common throughout Alaska, it is evident that stagnating per capita incomes are not a sign of a stagnant local economy. Rather, they are likely the result of the relatively rapid growth in service and retail sectors, sectors that traditionally pay less than the resource and manufacturing jobs that were more prominent in the smaller and less diverse economy of Alaska's past.

Table 3-101a: 1998 Real per capita income and average annual growth, for the United States, Alaska, and Southcentral Alaska.

	United States	Alaska	Municipality of Anchorage	Kenai Peninsula Borough	Valdez-Cordova Census Area
			Real 1995 Dollars		
Earned Income	17,247	17,649	21,523	14,978	18,333
Unearned Income	8.185	8,373	9,009	8,506	8,083
Total Income	**25,431**	**26022**	**30,532**	**23,484**	**26,416**
			Percent Average Annual Growth (1979-98)		
Earned Income	1.3	-1.7	-1.2	-1.9	-0.4
Unearned Income	2.2	3.4	3.7	3.1	3.6
Total Income	**1.5**	**-0.6**	**-0.3**	**-0.7**	**-0.1**

Source: U.S. Bureau of Economic Analysis, 2000.

Another important, but often overlooked fact evident in Table 3-101a is the increasing importance of unearned income in the study area and throughout the nation at large. Unearned income currently accounts for approximately one third of all income in each of the geographical areas shown in the Table, and growth rates for this income category have far exceeded those for earned income. Growth in unearned income in the study area has been significantly more rapid than the national average, rising from a base of approximately 15 percent of total per capita income to its current level. This is partially the result of the more rapid aging of the Alaska population, a demographic change that is closely linked to rising unearned income levels. The tendency for the Alaskan economy, as it grows and matures, to more closely resemble the national economy as a whole may also be partially responsible. Also note that "other benefit payments" (Table 3-101a) constitute a significant proportion of unearned income transfers to Alaskans. This is largely due to the Alaska Permanent Dividend Fund. This

Fund provides yearly dividends that in the $1,000 to $2,000 range for each Alaska resident.

Whatever the cause may be, the result of increasing unearned income is that a significant proportion of local income, as well as the additional economic activity this income generates, is not directly tied to any one specific industry. Another important consequence with more direct implications for forest planning is the fact that an increasing share of local income is linked to the residentiary decisions of people with incomes that are not tied to any specific location. Much of the benefits and investment income flowing to retirees, for example, can be received anywhere in the United States. In this case, the decision to reside in Alaska, and especially in rural Alaska, will be based on personal preference and local amenities rather than economic activity. For many Alaskans, proximity and access to natural environments and the various activities these environments support is a major amenity and a fundamental reason for their choice to live where they do. This becomes another important way in which the Chugach National Forest can contribute to local economies within the planning area.

These developments aside, it is important to note that some of the smallest and most isolated communities in the study area are still largely dependent on more traditional resource extraction and development activities, especially those associated with the fishing industry. Likewise, and as will shown in a subsequent section on communities, the economic changes seen in the region at large have not affected all communities equally, and significant differences in income are found between different localities.

Forest Resource Related Industries

The following section focuses on four industries that use forest-related resources in Alaska: commercial salmon fishing and processing, tourism and recreation, wood products, and minerals (excluding oil and gas). These are the four industries that are directly dependent on forest-related resources outputs and are the most likely to be impacted (positively or negatively) by Chugach National Forest management. These industries' production activities occur inside and outside the Forest, and in many cases, the Forest is not the only source of the resources upon which they rely.

Data for the following analysis were derived from several sources. The first data source is zip code level models developed through IMPLAN Pro, an input-output model commonly used by the Forest Service to estimate economic impacts of real or proposed forest management activities on local areas (MIG 1999). These data may be disaggregated so as to focus on a single community or any set of communities of interest and include detailed information not available from other state or federal data sources. One problem is that the latest data available is for 1996. Another problem is that, since a rather complex modeling process generates the data, its accuracy is limited. In the following analysis, the IMPLAN data was used to derive shares of employment by relevant sector for the year 1996. Data from a second set of sources, notably the U.S. Bureau of Economic Analysis' Regional Economic Information System (U.S. Bureau of Economic

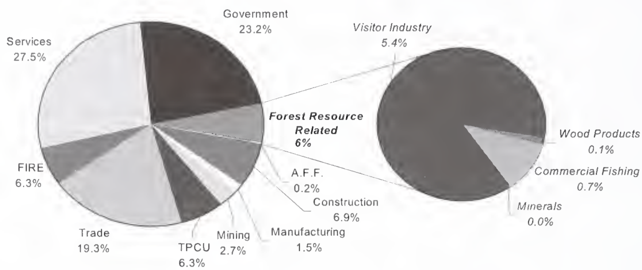
Analysis, 2000), is then used to determine recent trends in forest-dependent sectors as well as cross check the IMPLAN estimates.

For the IMPLAN analysis, the planning area has been divided into three smaller areas to be analyzed separately: (1) the Municipality of Anchorage; (2) the communities of Kenai and Soldotna (including Sterling) on the Kenai Peninsula; and (3) specific communities within or near the Forest boundary (Chenega Bay, Cooper Landing, Cordova, Girdwood, Hope, Moose Pass, Seward, Tatitlek, Valdez, and Whittier). These three groupings were chosen to prevent the larger Municipality of Anchorage and the communities of Kenai and Soldotna from overshadowing employment conditions in the smaller communities and to highlight differences in employment in the three areas. Note that the three groupings used in the IMPLAN analysis are not identical to those used with the Bureau of Economic Analysis data (which are consistent with the groupings used elsewhere in this Section).

Figures 3-83, 3-84, and 3-85 display IMPLAN derived estimates of direct employment by sector, with those industries that use forest-related resources summarized as a separate 'forest resource-related' category. The forest resource-related category is further divided into commercial fishing (commercial fish harvesting and seafood processing), wood products (logging and sawmills), minerals other than gas and oil, and the visitor industry. It is important to remember that, while this analysis estimates activity in forest-dependent industries, the firms that comprise these industries may, or may not, receive supplies from producers other than the Forest. Only a small proportion of tourists using Anchorage's airport, for example, will have traveled specifically for a recreation opportunity on the Chugach National Forest.

Since no one category or group of categories comprises the visitor industry, employment in this sector had to be estimated. In order to do this, we used a 1991 McDowell Group survey of Alaska businesses involved in providing goods and services to visitors (McDowell Group 1991, see Table in Economic Analysis in Appendix B for actual shares). Here, the average share of business activity in a specific sector that respondents attributed to visitor activity was use to derive estimated visitor-related activity and, ultimately, tourism-related activity for that sector. A similar approach, using the same reported shares, was used to derive estimates for tourism activity from the data provided by the Bureau of Economic Analysis. There are numerous potential sources of error in such an approach. One stems from the fact that relative growth in tourism will alter the actual share of business activity generated by tourism within a given sector. In the decade since the McDowell survey was conducted, it is likely that the shares have increased considerably along with the relative expansion of tourism. Another source of error is that the McDowell Survey could only consider a relatively small number of sectors. Many miscellaneous purchases by visitors may fall outside of the categories surveyed and thus fail to be counted. In either case, the error would be toward an underestimation of the tourism component of the local economy.

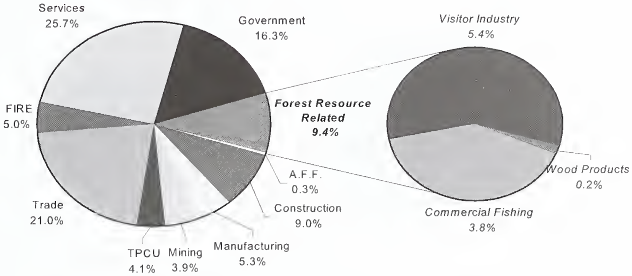
Figure 3-83: Municipality of Anchorage employment by sector highlighting forest resource related sectors 1996.



Source: MIG 1999, McDowell 1991.

The Municipality of Anchorage has both the largest population base and the largest workforce in Alaska. As displayed in Figure 3-83, in 1996 six percent of total employment was estimated to be in industries that use forest-related resources. Of this forest resource-related employment, the majority (5.4 percent of total employment) was within the visitor industry. Anchorage serves as a hub for tourism activity with extensive retail, service, and transportation businesses, including an international airport, and it is doubtful that forest planning decisions will impact this activity to any noticeable extent. Little of Anchorage's workforce is employed in manufacturing or related production activities that use forest-related resources; combined 1996 employment in the wood products and commercial fishing industries accounted for less than one percent of the total. Once again, these activities are not directly reliant on the Chugach National Forest. Owing to the small relative size of forest-dependent sectors, and their lack of a direct linkage to the Forest, it is unlikely that the overall level of economic activity in the Municipality of Anchorage will be significantly affected by changes in Forest management activities.

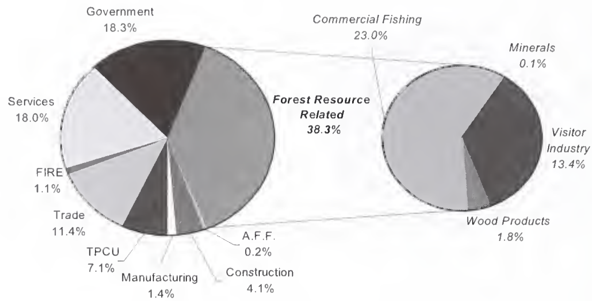
Figure 3-84: Kenai and Soldotna employment by sector highlighting forest resource related sectors, 1996.



Source: MIG 1999, McDowell 1991.

Together, the communities of Kenai and Soldotna also have a fairly large population base and serves as an economic hub to the smaller communities on the Kenai Peninsula. Figure 3-84 shows that the two communities have a larger proportion (9.4 percent) of total employment in forest resource-related industries than Anchorage. About 5.4 percent of total employment in 1996 was in the visitor industry, 3.8 percent was in the commercial fishing industry, 0.2 percent was in the wood products industry. These findings highlight both the world-class sport fishing opportunities (as partially reflected in the visitor industry numbers) and the well-established commercial salmon fishing fleet and seafood processing infrastructure in the area. Though decisions that significantly impact recreation activity in the surrounding area may have a marginal impact on activity in the visitor industry, changes in the management of the Forest would likely have only a limited impact on overall economic activity on these communities.

Figure 3-85: Other communities within or near the Chugach National Forest boundary employment by sector highlighting forest resource related sectors, 1996.



Source: MIG 1999, McDowell 1991.

The remaining communities within the planning area are smaller, and as a group have significantly more employment in forest resource-related sectors when compared to Anchorage, Kenai and Soldotna. In 1996, 38.3 percent of total employment in these communities was in forest resource-related industries. Employment in the commercial fishing industry accounted for almost two thirds of the forest resource-related sector employment, and the visitor industry accounted for most of the remaining third. The communities of Cordova and Seward have large fishing fleets and several seafood processing plants. Even in the smaller, inland communities of Hope, Girdwood, Moose Pass and Cooper Landing, residents are involved in the commercial fishing industry. Although the visitor industry does not account for the majority of employment in forest resource-related industries, the percentage of total employment in the sector was actually larger in this group of communities than it was in Anchorage, Kenai and Soldotna. Several communities have large tourist attractions, such as the Alyeska Ski Resort in Girdwood, the Sealife Center in Seward, and the sport fishing opportunities near Cooper Landing. Though more prevalent in these communities than in Anchorage, Kenai and Soldotna, wood products employment constitutes only a small proportion of forest resource sector employment. Most of this employment is in logging and is primarily associated with harvests from Native corporation and other private lands.

Income data available from the U.S. Bureau of Economic Analysis provides a different and slightly more recent view of the forest resource-related sectors in the planning area. Table 3-101b displays 1998 income in the forest resource sectors as a share of total earned income. The spatial units here are the same boroughs and census areas that were considered in the regional overview, and they are not directly comparable with the 1996 shares presented in Figures 3-83

to 3-85. The reporting years are different and the geographical areas are different (most importantly, Seward is now combined with Kenai and Soldotna). Another important difference is that income is quite a different measure from employment, and the prominence of lower wage activities (such as are common in the tourism trade) will be significantly smaller when viewed in terms of income rather than employment. In deriving tourism income estimates, the same methodology was used as that described for the derivation of Tables 3-83 to 3-85.

Table 3-101b: 1998 Shares of resource-dependent industry income relative to total earned income (percent).

	Municipality of Anchorage	Kenai Peninsula Borough	Valdez-Cordova Census Area
Commercial Fishing	0.2*	3.6*	4.8
Food Manufacturing	0.1	2.4	5.2
Mining (net of energy)	0.1	0.1	0.0
Wood Products	0.1	1.4	na
Recreation and Tourism	4.4	4.2	3.9

Source: U.S. Bureau of Economic Analysis, 2000.
* Figures are for 1997.
Note: Earned income for this Table was measured on a place-of work basis, meaning that non-resident workers are included. Food manufacturing is included as a proxy for seafood processing (see text). Recreation and Tourism is estimated using methodology described in accompanying text and Appendix B.

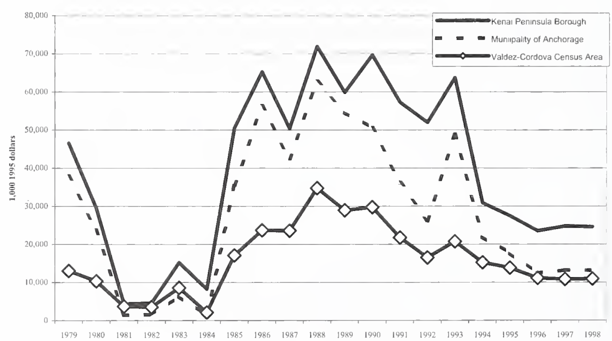
Despite of these discrepancies, the picture revealed by the income data is much the same as that displayed by employment. Anchorage exhibits little activity in the resource commodity sectors and a 4.4 percent share in the visitor industry (as compared to 5.4 percent for the employment measure in Figure 3-83). The commercial fishing and processing industry in Kenai Peninsula Borough has a combined 6 percent share of total earned income. Recreation and tourism accounts for a somewhat smaller proportion. In the Valdez-Cordova Census Area, commercial fishing and processing accounts for 10 percent of total earned income, and recreation and tourism for only 3.9 percent. Wood products income for the Census Area was not reported due to disclosure concerns, indicating that there is some activity in the sector but that less than three firms reported that year. Income was reported for the wood products sector in 1995 and 1996, and in those years it accounted for 4.6 percent and 3.4 percent of total income respectively.

The above statistics suggest that, when considered within the context of the Southcentral Alaska economy at large, the role that the Forest plays in providing employment opportunities is relatively small. This is partly a result of the overwhelming size of the Municipality of Anchorage, and to a lesser extent the Kenai Peninsula Borough, relative to the other communities in the study area. Many people in these smaller, more isolated communities are employed in forest resource-related industries, notably commercial fishing, and it is possible that planning decisions may have more dramatic affects when considered here at the local level.

Commercial Fishing

Commercial fishing is identified by the statistics presented above as the largest forest resource-related sector in Southcentral Alaska. Real income in the sector is displayed for the Municipality of Anchorage, the Kenai Peninsula Borough and the Valdez-Cordova Census Area. Perhaps surprisingly, all three boroughs show broadly comparable levels of commercial fishing income, and all three display extreme fluctuations including extremely low levels in the early 1980s quickly followed by peak levels in late 1980s that are close to ten times the previous lows. Fish processing income data was not available in time series due to disclosure holds, but the years that are reported indicate that processing income is approximately equivalent to commercial fishing income in the Valdez-Cordova Census Area and the Municipality of Anchorage, and approximately one third of fishing income in the Kenai Peninsula Borough. The severe volatility of commercial fishing income is indicative of an industry that is subject to various economic and ecological forces that extend well beyond the Forest's geographical boundaries and control. Nevertheless, much of the freshwater habitat for commercial fish species caught in the region, and especially in Prince William Sound, is found on the Chugach National Forest. Forest planning decisions have the potential to indirectly affect the commercial fishing industry, though the nature and magnitude of this impact is extremely difficult to predict. However, since the planning alternatives involve no extensive manipulation or disturbance of the landscape, any impacts to commercial fish harvests are likely to be small.

Figure 3-85a: Real income in the commercial fishing sector, 1979-98.



Source: U.S. Bureau of Economic Analysis, 2000.
Note: 1998 levels for Anchorage and Kenai-Soldotna are estimates.

Mining and Wood Products

Wood products and mining (not including oil and gas) comprise only a very small proportion of economic activity in the study area. This by no means implies that jobs in these sectors are not important to the individuals who hold them, but it does mean that their importance to the regional economy as a whole is quite limited. Mining accounts for slightly less than 0.1 percent of total employment in the region and is mostly limited to placer mines and local sand pits or quarries. Interested entrepreneurs have mentioned the possibility of developing recreational gold mining opportunities for visitors, but any such efforts are in the early stage of planning, if they are currently being considered at all.

The wood products sector has been somewhat more active, and has included various small-scale loggers operating portable sawmills, and a mill in Seward that employed approximately 100 people in 1990. The mill closed, however, in the mid-1990s. Much of the timber harvested and processed in Southcentral Alaska comes from sources other than the Forest, and it is impossible to say that the industry as it now stands is dependent upon the supply of timber from the Chugach National Forest. This conclusion is further supported by the fact that Chugach harvests have been quite small and that, on average, only 22 percent of the timber volume offered for sale over the last 20 years has been bought and harvested. This does not mean that, under the right economic conditions, the Chugach National Forest could not supply greater volumes to the wood products sector, but it does mean that the potential negative impacts of planning decisions on current activity in the sector are extremely small.

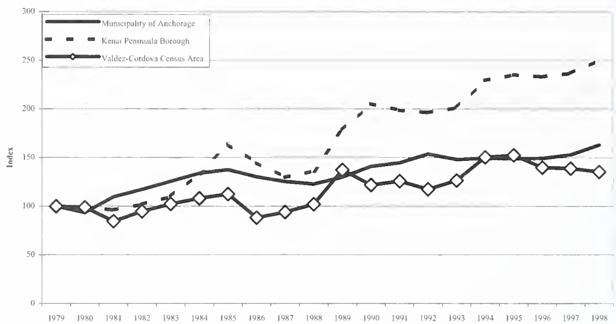
Recreation and Tourism

In the case of the visitor industry, the Forest Service may not be directly involved in providing employment opportunities, but it is a significant provider of resources such as scenery, recreation settings, and fish and wildlife habitat to the industry. Moreover, one of the major themes of the Revised Forest Plan is the allocation and management of recreation opportunities and activities. Consequently, it is in this area that the plan may have its most important economic impacts.

Figure 3-85b displays income in the visitor industry for the three boroughs in the study area. The figures were first adjusted for inflation and then indexed to 1979 so that they could be shown on the same scale. Growth in sector income has been impressive, especially for Kenai Peninsula Borough. Growth in the Municipality of Anchorage and the Valdez-Cordova Census Area is more modest, particularly in the Valdez-Cordova Census Area where fluctuations in growth rates have been extreme, but in either case sector income is approximately half again as large as it was in 1979. These rates of growth are considerably higher than overall income growth in any of the three areas. Moreover, visitor industry income was derived using the same methodology that was used for visitor industry employment in the previous section. Where the visitor industry expands more quickly than the regional economy at large, as is here the case, the share of specific industry activity attributable to visitors will be increasing, and estimates based on fixed shares will undershoot the true value. Consequently, the estimates presented here, which were based on 1991 survey responses, may be

considerably lower than actual income growth in sector. It is important to remember, however, that only portion of this growth (and a relatively small proportion for the Municipality of Anchorage) is attributable to the lands within the Chugach National Forest boundaries.

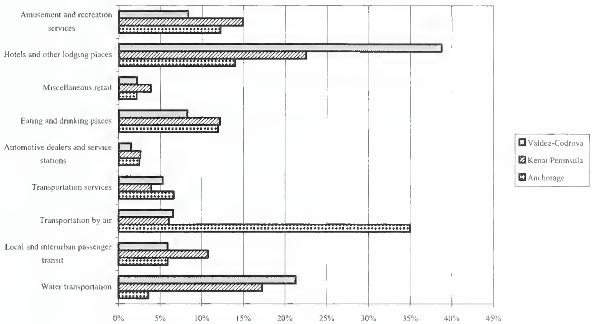
Figure 3-85b: Index of income in the visitor industry (adjusted for inflation), 1979-98.



Source: U.S. Bureau of Economic Analysis 2000. McDowell 1991.

As shown in Figure 3-85c, which displays visitor industry components as a share of total 1998 visitor industry income, transportation, hotels and other lodging, restaurants, and recreation services (including outfitters and guides) comprise the bulk of visitor industry activity. The actual distribution of activity varies considerably between each respective borough (or census area), with substantial concentrations of lodging activity in Valdez-Cordova Census Area and, to a lesser extent the Kenai Peninsula Borough. While water transportation is considerably higher in both of the outlying boroughs, air transportation is dominant in Anchorage owing, no doubt, to income associated with the Municipality's international airport. As before, errors in these estimates are potentially high, especially for the Valdez-Cordova Census Area, because the shares from which they are developed represent statewide averages, and small communities may deviate considerably from these averages.

Figure 3-85c: Major components of visitor industry by share of total visitor industry income, 1998.



Source: U.S. Bureau of Economic Analysis 2000. McDowell 1991.

Only a small proportion of the visitor industry identified in this section is susceptible to impacts from Chugach National Forest planning decisions. Activity in Anchorage may be slightly impacted through small increases or decreases of purchases of equipment and supplies by residents recreating on the Forest, but such impacts will likely be extremely small if noticeable at all. Activity in the Kenai Peninsula Borough and the Valdez-Cordova Census Area is more susceptible to impact if planning decisions significantly alter the nature or magnitude of recreation occurring on the Forest. In this case, however, the impacts may be quite place-specific and not large enough to register in the borough level statistics.

It is clear however, that recreation and tourism does contribute substantially to the economy surrounding the Chugach National Forest. A number of studies have estimated the magnitude of this contribution:

- Haley and others (1999) estimated that in 1993 Alaska resident anglers took 387,119 fishing trips to the Kenai Peninsula and Prince William Sound area, spending about $48.5 million dollars that supported an estimated 620 direct and indirect jobs in the region with an estimated payroll of over $14 million dollars. The same group estimated that in 1993 nonresidents took 87,738 fishing trips to these areas, spending about $32.9 million dollars that supported an estimated 649 jobs in the region with an estimated payroll of about $12.5 million dollars. (All of the above estimates are in 1993 dollars.)

- McCollum and Miller (1994) estimated that Alaska resident hunters took 39,185 overnight big game hunting trips to Southcentral Alaska in 1991, spent about $37 million dollars (1991 dollars) and supported an estimated 1,354 jobs in the area. The same authors estimated that nonresident hunters took 2,312 overnight big game hunting trips to Southcentral Alaska in 1991, spent about $14 million dollars (1991 dollars) and supported an estimated 322 jobs in the region. In the same year the authors estimated that Alaska resident voters took 83,773 overnight trips to Southcentral with a primary purpose of viewing wildlife, spent about $26 million dollars (1991 dollars) and supported an estimated 1823 jobs in the region.
- Miller and McCollum (1997) estimated that between May of 1993 and April of 1994 nonresidents took an estimated 23,072 overnight trips to Southcentral Alaska with the primary purpose of viewing wildlife. These visitors spent an estimated $8 million dollars (1993 dollars) that supported an estimated 257 jobs.
- Maharaj and Carpenter (1999) used data collected in the 1996 National Survey of Fishing, Hunting, and Wildlife Associated Recreation (USDI 1997) to estimate the economic contributions of fishing, hunting and wildlife viewing activities that occur on national forest lands. There were an estimated 1,584,728 freshwater fishing days on Alaska Region forestland in 1996, and the associated expenditures supported an estimated 2,872 jobs and over $60 million dollars in personal income The authors estimated that 326,742 hunting days took place on Region 10 forestland in 1996. Expenditures associated with these hunting days supported an estimated 1,126 jobs and over $22 million dollars in personal income. Finally, an estimated 372,113 wildlife viewing days took place on Region 10 forests and the associated expenditures were estimated to support 1,041 jobs and about $20.5 million dollars in personal income. (All of the above estimates are in 1996 dollars.)
- Fletcher, Kern, Merculieff, Voss, Williams and Selk (2000) estimated the annual total value of purchases of goods and services related to snowmobiles in the Anchorage and Mat-Su borough was $56,175,606. (Estimate in 1999 dollars).

Each of the above studies indicates that considerable income is generated by recreation activities linked to the Chugach National Forest. In many cases, however, it is important to remember that recreationists may be able to substitute with non-National Forest System lands should their access to the Forest somehow be constrained. Thus a change in recreation opportunities on the Chugach National Forest may not directly lead to economic impacts in the area around the Forest.

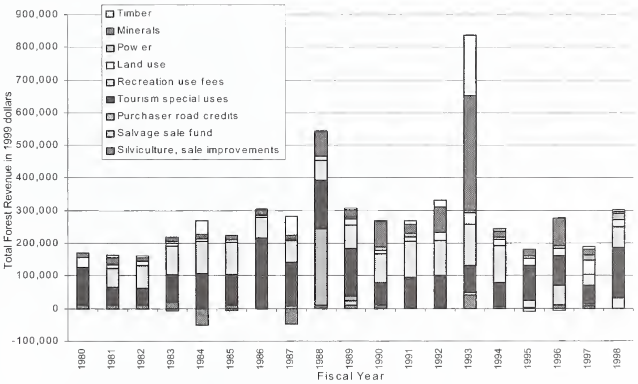
Payments to the State

Aside from providing a supply of forest-related resources to local industries, commercial use of the national forest has another benefit to surrounding communities. Under the National Forest Receipts Program authorized in 1908 ("the 25 percent fund"), national forests distributed 25 percent of total revenues earned from its activities to jurisdictions falling within forest boundaries for schools and roads.

However, in October 2000, the Secure Rural Schools and Community Self Determination Act was enacted to stabilize federal payments for schools and roads. The new legislation fundamentally changed the way the Forest Service returns a portion of its annual receipts to states. For fiscal years 2001 through 2006, boroughs can elect to receive a "full payment amount" which is an average of the three highest payments made to the state between 1986 and 1999. For Chugach National Forest communities, the total annual full payment amount would be $142,000. That amount will be distributed annually among the Municipality of Anchorage, Kenai Peninsula Borough, Kodiak Island Borough, Matanuska-Susitna Borough, City and Borough of Yakutat, Cordova, Valdez, Whittier, and the Chugach rural education assistance area.

The total revenue from the Forest from 1980 through 1998 in 1999 dollars is displayed in Figure 3-86. The 25 percent payment is based on two sources of revenue to the Forest - forest receipts and capital improvements. Forest receipts include the receipts the Forest collects form commercial uses of the Forest such as power production facilities, minerals, timber sales, tourism special uses, and for individual uses of facilities such as campground fees. Capital improvements revenue includes collections for activities such as salvage sales, silviculture, timber sale improvements, and purchaser road credits.

Figure 3-86. Chugach National Forest total revenue in 1999 dollars, fiscal years 1980-1998.



Source: USDA Forest Service 1999, Economic Report to the President 2000.

Community Social and Economic Conditions

The following section serves as a comparison and description of the social and economic conditions of the communities surrounding the Forest. In this analysis, 1990 census data is used as a baseline from which to compare more recent trends and information. The census is taken every ten years and is the only source of complete employment and income data available at the community level. Annual employment data that is available from the Alaska Department of Labor does not include self-employed people and is not reported at the community level. Income data is not releasable by the Department in any detail due to state disclosure laws, which are enforced to protect the privacy of individual firms. The data that is available is analyzed and presented to update census data.

Community Demographics

Table 3-102 illustrates the demographic diversity of the Forest communities of interest in terms of selected social and economic characteristics. In this Table their larger geographic area groups each of the 14 communities: Municipality of Anchorage, the Kenai Peninsula, and Prince William Sound.

Almost all of the communities have grown in population since 1990 with the Kenai Peninsula communities showing the largest percentage increases. Access to highways and road expansion tends to support greater growth in communities. Areas connected by highways to shopping and other amenities attract both residents and visitors. Such a pattern holds for the Municipality of Anchorage and the communities on the Kenai Peninsula. Seward, Hope, and Valdez, which are endpoints on highways, have slower population growth than the communities along highways. The communities in Prince William Sound have also increased in population, but not to the extent of those areas with highway access. Cordova's increase in population includes the annexation of the Native community of Eyak into the larger city in 1993.

Some communities have fairly low civilian unemployment, but a high percent of the population (16 years and older) not in the labor force. Cooper Landing, Hope, Chenega Bay, and Tatitlek had high levels of civilian unemployment and/or high levels of people not in the labor force. These communities have seasonal industries and often few employment opportunities. Chenega Bay and Tatitlek are small communities with little industry and whose remoteness isolates them from other communities and opportunities for commuting to other areas to work. Maintaining and creating local jobs in order to keep the younger population from leaving the area is often an issue of significant concern in these communities. Because the Chugach National Forest surrounds these areas, future employment opportunities are likely to be impacted by future planning decisions affecting access and resource use.

Table 3-102: Overview of community characteristics.

Community	1990 Population	1998 Population	1990 Median household income (dollars)	1990 Households below poverty level	1990 American Indian, Eskimo & Aleut	1990 Civilian unemployed	1990 not in labor force	Access	Subsistence preference
				Percent					
Municipality of Anchorage	226,338	258,782	43,946	7	6	7	26	Road	Non-rural
Girdwood	1,115	1,778				NA	NA	Road	Non-rural
Kenai Peninsula									
Cooper Landing	243	283	42,250	3	1	0	53	Road	Rural
Hope	161	135	17,250	33	3	38	50	Road	Rural
Kenai	6,327	7,058	42,889	7	8	12	38	Road	Non-rural
Moose Pass	81	134	22,083	0	11	25	25	Road	Non-rural
Seward	2,699	3,040	37,049	10	15	9	44	Road/Ferry	Non-rural
Soldotna	5,526	6,515	38,004	5	4	8	33	Road	Non-rural
Sterling	3,802	5,888	51,145	7	2	7	38	Road	Non-rural
Prince William Sound									
Chenega Bay[1]	94	69	22,083	26	69	14	42	Ferry	Rural
Cordova[2]	2,110	2,571	46,304	4	11	3	23	Ferry	Rural
Tatitlek	119	110	27,188	19	86	0	75	Ferry	Rural
Valdez	4,068	4,155	68,750	5	5	8	26	Road/Ferry	Non-rural
Whittier	243	288	33,636	13	12	8	37	Train/Ferry	Rural

NA = Not Available.
[1] Chenega Bay was built in its present location in the mid-1980s, due to the destruction of the original village site in 1964.
[2] Cordova annexed Eyak in 1993.
Source: Alaska Department of Labor, Research and Analysis, 1999; Alaska Department of Labor and Workforce Development 1998; U.S. Department of Commerce, Bureau of the Census 1990; USDI Fish and Wildlife Service 1998.

Community Employment

The 1990 Census employment data is displayed in Table 3-103. The sectors used in the census are not directly comparable to those defined in the regional section of this assessment. Additionally, the census data is a measure of the people in each industry not the number of jobs as defined in the regional section. Employment can be used as an indicator of a community's economic structure and may also be useful in predicting how Forest management might affect future economic conditions. This analysis of 1990 employment data has been supplemented with employment trend data for 1990-96 from the Alaska Department of Labor. While this additional data does not include self-employed persons, and in some cases, is not available at the community level, it is useful in examining changes in employment trends.

Although some trends are common to most Southcentral Alaska communities, as discussed above in the regional section, each community may be impacted differently by these trends. The agriculture, forestry and fishing sector is primarily composed of fish harvesters in Southcentral Alaska. Because most people employed as fish harvesters are considered to be self-employed they are not included in the Alaska Department of Labor statistics, but they are included in the census figures in Table 3-103. Employment within fish harvesting fluctuates greatly with the market demand, price and condition of the various fisheries. Seafood processing is another large industry in Southcentral Alaska. Employment in this industry is included in the manufacturing sector in Table 3-103 as is employment in the wood products industry. Employment in seafood processing also fluctuates in response to global fish markets. After the Tyson Seafoods processing plant in Kodiak burned down in early 1996, employment increased in this sector in Southcentral Alaska (Mosher 1998). Communities with seafood-processing plants include Anchorage, Cordova, Kenai, Soldotna, Seward, Valdez, and Whittier. Chenega Bay and Tatitlek are both involved in seafood harvesting and processing, including some oyster farming.

Mining includes oil and gas as well as hard rock mineral activities. In Southcentral Alaska, most employment within the mining sector is related to oil and gas development and is concentrated in Kenai, Soldotna, Sterling, and Valdez with Anchorage serving as headquarters for several related companies. Employment opportunities within this sector fluctuate with markets and access to resources. Employment within the mining sector has declined within the Municipality of Anchorage, Kenai, and Valdez since 1990, whereas Sterling and Soldotna have had increases in mining employment as resource exploration and development continues in the area.

Construction sector employment levels depend on community needs, federal, state and local budgets for building infrastructure and repairing or upgrading existing structures. More recent trends highlight construction in Seward where several projects, including a dock, a prison and the Sealife Center have led to continued employment opportunities in this sector. Kenai, Soldotna and Sterling also have significant employment in construction due to both population growth and the development of several service/retail structures since 1990.

Table 3-103: Chugach National Forest 1990 economic sector employment by community (percent).

	A.F.F.*	Mining*	Construction*	Manufacturing*	T.P.U.C.*	Wholesale Trade*	Retail Trade*	F.I.R.E.*	Services*	Public Administration*	Shannon-Weaver Diversity Index*
Municipality of Anchorage											
Municipality of Anchorage	1	5	6	4	11	4	17	6	34	12	.93
Kenai Peninsula											
Cooper Landing	28	0	14	0	0	0	10	0	35	13	.60
Hope	0	0	11	15	0	11	34	0	28	0	.53
Kenai	4	13	5	12	5	4	20	3	27	7	.92
Moose Pass	26	0	0	0	0	0	74	0	0	0	.20
Seward	9	2	4	12	9	3	18	3	28	12	.91
Soldotna	2	7	5	5	4	3	24	4	37	9	.89
Sterling	1	11	12	5	7	4	20	1	32	9	.89
Prince William Sound											
Chenega Bay	56	0	0	8	0	0	0	0	25	11	.56
Cordova	25	0	6	12	11	2	11	3	23	7	.87
Tatitlek	0	0	0	0	0	0	0	0	47	53	.31
Valdez	3	5	10	4	23	2	12	2	31	9	.90
Whittier	11	3	10	2	26	0	8	7	21	11	.77

Source: U.S. Department of Commerce, Bureau of Census 1990.
* For definitions see Table 3-100.

As mentioned above, the manufacturing sector includes logging and sawmill operations. Similar to the fishing industry, many people employed as loggers or who have portable sawmills are self-employed and not counted in the state statistics but are included in the census data in Table 3-103. Currently in Southcentral Alaska there are a few small mills on the Kenai Peninsula employing a few people. The sawmill in Seward employed over 100 people in 1990, but closed in the mid-1990s when increases in export log prices made exporting raw logs more profitable than processing them. A sizable proportion of people in Tatitlek are employed in logging, with smaller percentages in Anchorage, Cordova, Kenai, Seward, Soldotna, Sterling and Valdez. Logging employment can be transient. Communities with active timber harvesting will show a large amount of logging employment during harvest operations, but after the sale is over, the employment shifts to the next area.

The wholesale trade, retail trade, financial-insurance-real estate (F.I.R.E.) and services sectors have all increased in size, with retail trade and services increasing to a greater extent than the other sectors. This is a state as well as a national trend, arising from more people having more money to spend on goods and services. In Southcentral Alaska, the communities with highway access have shown the most growth since 1990 as these areas service more remote areas. Communities directly connected to tourism activities, such as Girdwood, Cooper Landing, Kenai, Soldotna, Sterling and Seward have experienced more than a 100 percent increase in retail trade and services sector employment since 1990. Even communities with little or no employment in these sectors in 1990, such as Chenega Bay, Moose Pass, and Tatitlek have seen increases in employment in these sectors. These trends highlight not only an overall increase in visitors demanding services, but also an effort on the part of communities to create a tourism industry.

People who are not necessarily attached to a single location for work as well as retirees with outside incomes are finding Southcentral Alaska communities attractive places to live and work. These people are creating employment opportunities in health and social services, as well as many other services.

Local education, which is included in the Services sector in Table 3-103, and the government sector are also important sources of employment in many of the Southcentral Alaska communities. In some of the smaller communities such as, Chenega Bay, Hope, Tatitlek, and Whittier, education offers one of the few permanent job opportunities in the community. Government employment tends to pay well and be year round – moderating some of the effects of seasonal and lower-wage employment within a community. Overall, government employment has been slowly declining as federal, state and local budgets decline.

The Shannon-Weaver (S-W) diversity index is a method of measuring how evenly a variable is distributed across the categories in which it is reported (Shannon and Weaver 1949). In this analysis the S-W method has been used to provide a measure of a community's employment diversity. The percent employment within an industry was measured relative to the total employment in the community. A community with employment in many different industries will

have a higher S-W score than a community with substantial concentrations of employment in a single industry. While no community, even an extremely diverse one, will have a perfect distribution of employment, the S-W index is useful in comparing communities within the same area. Analyzing the 1990 community population figures from Table 3-102 together with the employment diversity scores in Table 3-103 reveals that for the Forest communities of interest the two are closely correlated. The communities with the lowest employment diversity scores -- Moose Pass, Tatitlek, Hope and Chenega Bay – also had the smallest populations in 1990. Similarly, Anchorage and Kenai had both the highest diversity scores and the largest populations. Whittier, Seward, and Valdez had higher employment diversity scores than their population sizes would suggest, which may be due to their favorable locations for transportation-related economic activity.

Community Surveys

In addition to available secondary social and economic data sources, the Forest accessed original information from local residents. In early 1998, Alaska Pacific University (APU) conducted a social survey, "Planning for the Future of the Chugach National Forest" (Alaska Pacific University 1998), of residents in 12 communities neighboring the Forest for the purpose of better determining the attitudes of residents regarding (1) specific forest management and allocation issues, (2) general forest uses, and (3) ecosystem values present in the Forest. The 12 communities surveyed were Anchorage, Cooper Landing, Cordova, Girdwood, Hope, Kenai, Moose Pass, Seward, Soldotna, Sterling, Valdez and Whittier. (Tatitlek and Chenega Bay, both Alaska Native villages in Prince William Sound, were also included in the survey; however, extremely low response rates for both resulted in excluding them from either individual or aggregate community findings.) More than 2,400 households from the 12 communities were surveyed using a mail questionnaire, with households selected at random from a sampling frame of all Alaska households with at least one State Permanent Fund Dividend (PFD) applicant in 1997. The overall response rate for the 12 communities surveyed was approximately 31 percent, ranging from a high of 44 percent for Moose Pass and Cooper Landing to a low of 23 percent for Whittier.

APU followed up with a similar survey in 1999, "Your Community's Quality of Life" (Alaska Pacific University 1999), which was directed toward determining community resident attitudes toward quality of life (QOL) in their communities and public land management affects it. The same 12 communities were again sampled using the state's PFD database. This second survey focused on (1) resident feelings about the importance of and satisfaction with a number of social, economic, and environmental attributes of their community, (2) preferences for growth in various economic sectors, and (3) evaluations of the resiliency of their community. This survey was mailed to approximately 2,200 residents, with an overall response rate of approximately 24 percent, ranging from a high of 34 percent for Cooper Landing to a low of 18 percent for Whittier.

It was more the aim of these two APU surveys to learn about the differences among the communities rather than to derive a single overall forestwide picture. Consequently, sampling plans for both surveys were prepared as individual random samples for each community, and thus were not stratified or weighted by community population when arriving at aggregated forestwide summary statistics. When aggregated forestwide results were calculated they were arrived at through simple equally weighted averages of the 12 communities. To weight the communities by their population would have strongly biased the results toward the attitudes of Anchorage residents since its population (1998 estimate of 259,000) accounts for approximately 90 percent of the total population of the 12 communities together.

The statistical significance of the results of the two surveys are difficult to assess and summarize for several reasons, including (1) small and differing population sizes and (2) diversity of statistical measures used and degrees of specificity in the questions themselves. For example, while one community may have had enough respondents to reach the intended level of significance, another community being compared to it might not. Another problem in trying to assign a single measure of significance or confidence level in survey results is that the required minimum sample size may differ by type of question phrasing. That is, the required sample size for questions determining averages may be different than that required for multiple-choice categorical response questions.

The actual response rates from the communities did not achieve the desired response rate. (There are a number of possible reasons why this did not occur. It is fair to note that Alaska residents in general may respond to surveys in fewer numbers than other states if response to the 1990 and 2000 national census household surveys are an indication. For both national censuses, Alaskan residents had the lowest response of rate of any state or territory in the nation.) However, it is also worth noting that the response rates achieved for the APU surveys, while less than desired, were nonetheless comparable to other national social surveys regarding public attitudes toward the environment.

For the reasons stated above, some survey results may have achieved the desired significance and confidence levels (especially where sample variances were negligible, for example), while others (where sample variances were large, for example) may not have.

Because of the complexity of documenting which results are or are not statistically significant across communities, no attempt has been made to distinguish among the two in the following discussion of the survey results. Nevertheless, without other comparable, original information addressing the points covered in the APU surveys, the survey results do represent the best single estimates of how the residents of each community feel about a considerable range of subjects. The (1) external consistency of resident attitudes across communities, (2) internal consistency of residents within a community across related questions, and (3) the “face validity” of survey responses with other public comments received suggest that the survey results are valid. The risk of drawing grossly incorrect inferences from the survey results is felt to be

minimal. This is particularly true considering the results have not been used in connection with other mathematical formulas that determine amount or economic value of resources or public uses by alternative.

Lastly, it may be worth noting that differences among communities found in survey results may be significant from a statistical standpoint but not from a substantive, or practical, standpoint. For example, the attitudes of residents of one community may average 1.5 on a 5.0-point scale, while those of another community may average 1.6. The difference between the two communities may be statistically significant but not so different that they warrant the implementation of two different management strategies. Further, it may be next to impossible to incrementally adjust the implementation of a single management strategy across the two communities that somehow correspondingly reflect such small variations in resident attitudes.

"Planning for the Future of the Chugach National Forest" Survey

General results of the survey indicate that with regard to attitudes toward Forest management issues preferred Forest uses, and values of Forest ecosystems, the communities surrounding the Chugach Forest are generally comparable to a random sample of people elsewhere in Alaska. At the same time, when looking at more specific issues, no two communities are exactly the same in their attitudes towards or preferences for specific Forest activities. Survey results suggest that the geographic location of the communities and associated social and economic characteristics can influence, and in many cases help explain, observed similarities and differences between the attitudes of respondents of the 12 communities. A significant portion of the public is interested in how the Forest is managed and, especially, how it is managed for amenity values rather than commodity values.

"Your Community's Quality of Life" Survey

The survey focused on community importance ratings for and satisfaction with 30 pre-selected quality-of-life elements. Those quality-of-life factors that are related to public lands, or may be directly affected by public land management decisions or activities are referred to as 'public land factors' (PLF). These are the factors over which the Forest may have the greatest influence although the degree of influence varies within this set of factors. Communities were also asked to rank, by importance and satisfaction, 19 pre-selected public land uses or opportunities.

Community resiliency is a concept used to describe a community's ability to adapt and respond to change. Adopting a measure similar to that used by Harris and others (2000) in their study of communities in the interior Columbia River basin, resiliency scores were calculated for the 12 Forest communities based on responses to survey questions regarding community regional amenities, social organization, economic structure and civic leadership. Changes in land management policies may have greater or longer lasting effects on less resilient communities. Community resiliency rankings are reported below.

In most communities the majority of respondents felt that local community interests should be given more attention than national interests in public land use

planning near their community. In all communities at least 2 of the top 5 factors ranked most important to quality of life, were factors considered to be PLFs. This highlights the importance of the Chugach Forest and future management to the 12 surrounding communities.

The following section presents key findings of these two surveys, summarized by general issue or concern. For complete details and specific discussion, the reader is referred to the Social and Economic Assessment (Crone et al. 2000).

General forest values and attitudes:

- Among 13 different forest ecosystem values recognized as present in the Forest, (1) recreation, (2) life support, (3) aesthetic, and/or (4) subsistence values are more consistently rated high among respondents in all communities. Cultural, historic, and spiritual values are more consistently ranked low among respondents in all communities.
- Among 19 different forest uses, a majority of respondents in 11 of the 12 communities (excepting Seward) generally favor nonconsumptive, low impact forest uses (e.g., fish and wildlife habitat, camping and picnicking, and nonmotorized recreation) over consumptive, higher impact forest uses (e.g., commercial mining, oil and gas, and logging)—although no uses were substantially opposed.

Forest resource use and management:

- Majorities in all communities indicate a preference for an annual timber harvest at or below 2.1 million board feet (the average annual cut on the Forest over the past 13 years). Among a variety of possible reasons to log in the Forest:
    - removal of dead or infested trees;
    - fire prevention and protection of life and property; and,
    - creation of wildlife habitat

  are the most acceptable reasons to respondents in all communities.

Considering all public land value responses from the 12 communities surveyed,

- Of 19 public land uses (opportunities) the uses with the highest average importance ratings across communities are:
    - fishing;
    - hunting; and,
    - undeveloped land/wilderness.

- The lowest average importance ratings are for:
    - trapping;
    - ATV/ORV (OHV) areas; and,
    - scenic drives.
- Of 19 public land uses (opportunities) the uses with the highest average satisfaction ratings across communities are:
    - scenic landscapes; and,
    - viewing wildlife.
- The lowest average satisfaction ratings are for:
    - jobs from logging and mining;
    - access for disabled people; and,
    - ATV/ORV (OHV) areas.
- In 8 of 12 communities, the response chosen most often regarding the desired future level of economic activity in the forestry/forest products sector in their community was "no change." In every community a larger percentage of respondents favored an increase over a decrease in this sector.
- The response chosen most often in every community regarding activity of the mining sector was no change from current levels. Cooper Landing, Hope-Sunrise, Moose Pass and Soldotna had larger percentages of respondent's favoring a decrease over an increase in mining activity in their communities.
- In the communities of Kenai, Sterling and Soldotna the largest percentage of respondents favored an increase in oil and gas activity in their communities, while in all other communities the response chosen most often was for no change in the level of activity in this sector.

Recreation and Tourism

- A majority of respondents in 8 of the 12 communities (excepting Anchorage, Kenai, Soldotna, and Sterling) indicate that the proper Forest response to increased use of Prince William Sound due to the new Whittier Road is to develop minimal new facilities to mitigate impacts rather than more facilities to enhance use.
- Whittier, Anchorage, Cordova, Valdez and Girdwood each had a majority of respondents favoring an increase in the tourism services sector, while all other communities had a majority of respondents favoring no change in this sector in their community. The communities of Soldotna, Seward and Sterling each had more

respondents favoring a decrease in tourism services than an increase.

Special Designations

- Wild and Scenic River recommendations will be considered in the Forest Plan revision. A majority of respondents in all communities indicate that they prefer as many as five or more rivers in the Forest be congressionally designated as Wild and Scenic.
- Wilderness recommendations will also be considered in the Forest Plan revision. A majority of 9 of the 12 communities (excepting Hope-Sunrise, Soldotna, and Sterling) indicate that they prefer as much as 1.7 million acres or more of the Forest be congressionally designated as Wilderness.

Forest access

- A majority of respondents in all communities indicate a preference for five or less new roads in the Forest. Among a variety of possible reasons to construct new roads in the Forest, vegetation management was the reason chosen most often by respondents in 9 of the 12 communities (excepting Cordova, Valdez, and Whittier).
- A majority of respondents in 10 of the 12 communities (excepting Sterling and Valdez) indicate a preference for the current amount of open area and season in the Forest for snowmachine use. More communities secondarily prefer increased access than prefer decreased access.
- A majority of respondents in 10 of the 12 communities (excepting Anchorage and Valdez) indicate a preference for the current amount of open area and season in the Forest for off-road vehicle use.

Community quality of life values

Considering all responses from the 12 communities surveyed,

- The three most important public land factors (PLFs) to quality-of-life are:
  1) clean air & water;
  2) beauty of the surrounding area; and,
  3) open undeveloped areas.
- The three PLFs ranked lowest in importance are:
  1) subsistence gathering;
  2) subsistence hunting and fishing; and,
  3) sport hunting and fishing.

- The three PLFs respondents were most satisfied with are:
  1) beauty of the surrounding area;
  2) clean air and water; and,
  3) open, undeveloped areas.
- The three PLFs ranked lowest in terms of satisfaction are:
  1) the roads/transportation system;
  2) access to and use of public lands; and,
  3) subsistence hunting and fishing.
- The largest divergence between satisfaction and importance ratings for the PLFs occur for:
  1) job/employment opportunities;
  2) the roads/transportation system; and,
  3) clean air and water.
- Whittier, Kenai, Anchorage and Valdez appear to be the most in favor of additional growth in their communities. Hope-Sunrise, Cooper Landing, Girdwood and Moose Pass have the smallest percentage of respondents in favor of additional growth.
- The self-assessed overall average quality-of-life and community resiliency rankings (from highest to lowest) by community for the Forest communities of interest are:

Community quality of life	Community resiliency
Girdwood	Cooper Landing
Cooper Landing	Moose Pass
Moose Pass	Anchorage
Hope	Girdwood
Sterling	Seward
Anchorage	Hope
Cordova	Cordova
Seward	Soldotna
Kenai	Kenai
Valdez	Valdez
Soldotna	Sterling
Whittier	Whittier

Most of the above key findings vary by community, so to analyze the effects of land management activities in particular locations it may be important to look at the specific results for communities located near the proposed activities.

Environmental Consequences

Economic Effects

This section describes the projected economic effects of each of the eight Forest plan alternatives. The analysis is divided into two main sections: impact analysis and efficiency analysis. Impact analysis refers to the estimation of employment levels and income associated with projected implementation of a given alternative in forest-related resource industries. Efficiency analysis attempts to measure all of the costs and benefits to society, both future and present, of a planning alternative. These benefits are not restricted to cash transactions, but also include non-market benefits. The concepts and methodologies used in each of these analyses are described in detail in the following subsections.

Impact and efficiency analyses measure different things and are not directly comparable. Planning alternatives with positive impacts on jobs and income will not necessarily entail high benefits under efficiency analysis. This is because impact analysis views employment as a benefit, while efficiency analysis views wages to employees as a cost that reduces the net benefits to society.

Recreation and tourism, mining, and salmon harvesting, while important in the calculation of both employment levels and the values associated with efficiency analysis, either do not vary significantly between alternatives or cannot be quantified with currently available data. Since timber is the only resource output projected to vary in any significant and easily quantifiable manner among the alternatives, it is the only resource quantified in the impact and efficiency analysis. While recognizing that recreation and other non-priced or non-market values do support economic opportunity and are a major component of the total value society derives from the Forest, the nature and potential importance of these values will be discussed only qualitatively.

Economic Impacts Analysis

Economic impact analysis examines the impacts of the alternatives on the economies most likely to be affected by the management of the Chugach National Forest. These impacts result from the economic opportunities increased or decreased as a result of the plan decisions. As this section will describe the economic opportunities sustained by the plan are not expected to vary substantially among the alternatives. The areas most affected by the plan are Recreation and Tourism, Wood Products, Commercial Fishing and Mining. Most of the effects are described in terms of employment and income; or in a more general narrative when employment or income differences cannot be identified.

Recreation and Tourism. Recreation and tourism is projected to increase at the same rate in all alternatives over the next ten years. The Recreation and Tourism section of this document projects that this increase will lead to approximately 25 percent more recreation visits in the next decade on the Chugach (summary effect of Table 3-56d). This implies an annual growth rate of slightly more than 2 percent. This compares to an estimated increase in summer

visitors to Alaska of nearly 60 percent experienced from 1990 to 1998 or an annual increase of 6 percent per year (McDowell Group May 1999). It is anticipated that the increase in recreation and tourism recently experienced by the Chugach National Forest will continue but at a lesser rate than that experienced in the 1990s.

Employment in the aggregate economic sectors most associated with recreation and tourism (Transportation, Retail Trade and Services) has also expanded over the past same period in the Municipality of Anchorage, the Kenai Peninsula Borough and the Valdez-Cordova Census Area. These annual growth rates have been roughly 3 percent for the Municipality of Anchorage, 3.5 percent for the Kenai Peninsula Borough, and slightly less than 3 percent for the Valdez-Cordova Census Area (Source Bureau of Economic Analysis, Regional Economic Information System). These high rates of employment growth are not expected to continue, although continuing annual increases in employment in these sectors on the order of 1.5 to 2.5 percent are likely for the future. Recreation and Tourism activity is particularly dependent upon trends in the broader economy. The nineties was a period of sustained economic growth that supported tourism opportunities. Recession or economic difficulties in the national and international economies pose risks for decreased growth or even declines in tourism activity and visitation. Tourism employment in Alaska has a seasonal nature concentrated in the summer months. During the winter months, recreation by Alaska residents supports most of the recreation/tourism opportunities.

With the exception of the employment in the transportation sector, most of the jobs related to tourism and recreation pay relatively lower salaries than those in other sectors. Thus while it is likely that there will be continuing growth in tourism and recreation employment in the future, many of these opportunities are not expected to provide family wage incomes and may be quite seasonal in nature. Recreation and tourism does provide opportunities for the formation of a number of small independent businesses.

In order to estimate employment impacts associated with recreation several, elements are necessary to conduct a reasonable and meaningful analysis:

- Variation in the magnitude of recreation use between the alternatives needs to be estimated. As discussed in the recreation section, the supply of recreation opportunities on the Forest is expected to exceed the demand for such opportunities across all alternatives for the next ten years. As Table 3-56d indicates total recreation in 2010 is projected to be 10.2 million visits. Of these visits, 3.6 million are expected to be in developed sites and 6.6 million dispersed visits. The only real difference between the alternatives is a partitioning of this dispersed use between areas recommended as Wilderness and those that are not recommended as Wilderness. This differentiation does not provide enough information for economic impacts to vary by alternative.

- Even if there were significant variations, in order to generate estimates of the impacts associated with each alternative, estimates of the variation in resident and nonresident visitation for each type of recreation activity (developed camping, snowmachining, mountain biking, backpacking, etc.) by alternative is necessary.
- Expenditure estimates must match or be easily converted to match the units of measurement and categories in which the visitation data are recorded. For example, for each fishing visit, what is the average amount of purchases for fish equipment?
- The visitation and expenditure data should be collected with as much geographic specificity as possible, so that expenditures and the resultant associated economic activities are attributed as closely as possible to the areas where they are actually occurring.

Since none of these elements were adequately met for the recreation and tourism activities presently taking place on the Forest, no impact analysis is quantified. However, differences in the alternatives are likely to affect direct economic opportunities and these are qualitatively described by alternative as follows:

Common to all alternatives are the following:

- Existing developed recreation facilities including campgrounds, cabins, trails and roads remain unchanged. Economic impacts based on such current facilities will continue across all of the alternatives
- Recreational businesses that are emphasized or limited in the alternatives will have a group of associated impacts that can be expected to occur in the broader economy, particularly in the Anchorage area which is the major retail center for the region. Examples are the use of transportation (rentals) and overnight lodging by visitors in Anchorage prior to or after participating on a driving or sea kayak tour; or residents who purchase ski or snowmobile equipment for their activities to the extent that they occur in the alternatives.
- Continuation of traditional activities in Wilderness and other designated areas and subsistence activities will continue in all alternatives. These activities by their nature provide important economic benefits. However, they do not include commercial enterprises that are the primary focus of the following discussion.

The **No Action Alternative** will support a mix of recreational employment opportunities. The Kenai Peninsula would be dominated by road-supported and motorized recreation opportunities favoring businesses that supported these uses such as roadside lodges and stores, snowmachine supplies and day use guiding or tours. The Whittier portal and much of Prince William Sound

accessible from Whittier will support limited recreational developments and businesses such as day kayaking, boating, and support businesses in Whittier. Large wilderness areas in the north and south of Prince William Sound provide opportunities for businesses supporting low impact wilderness recreation, such as longer kayak or boat tours and remote wilderness tours. Although remote from population areas, the east side of Prince William Sound and Montague Island provide for a broader range of recreational activities. This creates opportunities for businesses integrating transportation with various recreational opportunities including motorized and potentially road-based opportunities such as heli-skiing or cruises to remote locations for overnight stays. Most of the Copper River Delta offers opportunities for similar types of businesses integrating transportation with some recreational developments such as OHV accessed hunting or fishing, and heli-hiking. Road corridors, along the Copper River Highway and the Carbon Mountain Road in the Copper River Delta, provide for some increase in businesses that support road accessed recreation.

The **Preferred Alternative** will support a mix of recreational employment opportunities. The Kenai Peninsula would favor road-supported recreation opportunities from existing highways benefiting businesses that supported these uses such as roadside lodges and stores. Summer nonmotorized and a mix of winter motorized and nonmotorized recreation provide business opportunities for a range of businesses such as snowmachine supplies and day use guiding and tours. The Whittier portal and much of Prince William Sound accessible from Whittier will support limited recreational developments and businesses such as day kayaking, boating, and support facilities in Whittier. There are two locations to support groups in the Prince William Sound creating opportunities for businesses that can assemble groups to take advantage of these sites. Large wilderness areas in the north and south of the Prince William Sound provide opportunities for businesses supporting low impact wilderness recreation such as longer kayak or boat tours and remote wilderness tours. The east side of Prince William Sound and the Copper River Delta provide primarily for similar remote kinds of recreation, although motorized opportunities encourage some businesses integrating motorized access such as helicopter and OHV with recreational opportunities. Recreation developments along the Copper River Highway and the Carbon Mountain Road will be continued and expanded; thus supporting road related businesses.

Alternative A will favor recreational employment related to motorized recreation, tourism facilities and road-supported recreation. The Kenai Peninsula would be dominated by road-supported and motorized recreation opportunities favoring businesses that supported these uses such as roadside lodges and stores, snowmachine supplies, and day use guiding or tours. The Whittier portal and much of Prince William Sound would be available for recreational developments such as docks and campgrounds and businesses that supported this recreational activity such as camping/fishing supplies, road or boat accessible hiking, and day use tours. The Copper River Delta would also have increased opportunities for road related and motorized recreational businesses based on developments along the Copper River Highway and Carbon Mountain Road. However, given

the current limited highway access to the area, businesses would have a limited ability to take advantage of these opportunities. This alternative will still provide for economic opportunities related to nonmotorized dispersed recreation such as tours and kayaking in remote nonwilderness settings, but these will be subordinate to more intensive motorized recreation.

Alternative B will favor recreational employment related to motorized recreation, recreation facilities and road-supported recreation. The Kenai Peninsula would be dominated by road-supported and motorized recreation opportunities favoring businesses such as roadside lodges and stores, snowmachine supplies, and day use guiding or tours. The Whittier portal and some of Prince William Sound would be available for recreational developments such as campgrounds and docks favoring businesses such as camping/fishing supplies, boats to accessible hiking or day use kayak/boat tours. Much of the Prince William Sound will provide for business opportunities related to nonmotorized dispersed recreation such as tours and kayaking in remote settings. The east side of the Prince William Sound and the Copper River Delta would also have increased opportunities for road related and motorized recreational businesses such as OHV/snowmachine tours, heli-skiing and roadside lodges and stores.

Alternative C will support a mix of recreational employment opportunities. The Kenai Peninsula would favor road-supported recreation opportunities from existing highways such as roadside lodges and stores. An emphasis on summer nonmotorized and winter motorized opportunities provide business opportunities for a range of businesses such as snowmachine supplies and day use guiding and tours. The Whittier portal and much of Prince William Sound accessible from Whittier will support limited recreational developments and businesses such as day kayaking, boating, and support facilities in Whittier. Large wilderness areas in the north and south and nonmotorized backcountry in the east side of Prince William Sound provide opportunities for businesses supporting low impact recreation such as longer kayak or boat tours and remote wilderness tours. The focus on a number of scattered facilities to support groups throughout Prince William Sound creates opportunities for business that can assemble groups to take advantage of these sites and then access remote locations. The west side of the Copper River Highway and some locations on the east side of Prince William Sound provide summer and winter opportunities on the west side encouraging businesses integrating motorized access such as heli-skiing and OHV or snowmachine tours. Recreation developments along the Copper River Highway will be continued and possibly expanded, thus supporting road related businesses such as roadside lodges and stores.

Alternative D emphasizes more remote dispersed opportunities and limits motorized recreation. On the Kenai Peninsula, an emphasis on summer and winter nonmotorized opportunities provide business opportunities for day use guiding, ski touring, and more remote wilderness and backcountry recreation tours. The Whittier portal and the area immediately accessible from Whittier will support limited recreational developments and businesses such as day kayaking, boating, and support facilities in Whittier. Large wilderness areas and

backcountry nonmotorized areas predominate both sides of Prince William Sound providing opportunities for businesses supporting low impact wilderness recreation such as longer kayak or boat tours and remote wilderness tours. Large wilderness areas on the east side of the Copper River Delta provide a similar situation. There are some locations to support groups in Prince William Sound creating opportunities for businesses that can assemble groups to take advantage of these sites. There are areas on the west side of the Copper River Delta, the eastern part of Prince William Sound and some locations in the Kenai that provide summer and winter motorized recreation opportunities encouraging businesses integrating motorized access such as heli-skiing and OHV or snowmachine tours. The Kenai Peninsula and the Copper River Delta would provide a narrow corridor along existing highways supporting businesses such as roadside lodges and stores.

Alternative E emphasizes more remote dispersed opportunities and limits motorized recreation. The magnitude of formal wilderness may serve as a greater attraction for nonresidents seeking such opportunities. On the Kenai Peninsula an emphasis on summer nonmotorized and winter nonmotorized opportunities provide business opportunities for day use guiding, ski touring, and more remote wilderness and backcountry recreation tours. The Whittier portal and the area immediately accessible from Whittier has opportunities to support limited recreational developments and businesses such as day kayaking, boating, and support facilities in Whittier. Large wilderness areas and backcountry nonmotorized areas predominate both sides of the Sound providing opportunities for businesses supporting low impact wilderness recreation such as longer kayak or boat tours and remote wilderness tours. Large wilderness areas and Wild River designation on both sides of the Copper River Delta provide a greater emphasis for similar types of wilderness-based businesses. There are two locations to support groups in Prince William Sound creating opportunities for businesses that can assemble groups to take advantage of these sites. There are a few areas that provide winter and a few summer motorized recreation opportunities supporting businesses integrating motorized access such as heli-skiing and OHV or snowmachine tours. The Kenai Peninsula and Copper River Delta highway corridors would remain essentially in their current condition, supporting road related businesses such as roadside lodges and stores.

Alternative F essentially has the same effects as Alternative E. The major additional emphasis is that it focuses on a much greater amount of wilderness. As suggested under Alternative E, such a magnitude of wilderness may serve as to attract national and international visitors seeking wilderness, but discourage others seeking a greater mix of dispersed recreation opportunities such as motorized use.

Wood Products. To provide a reference for comparing the alternatives, the No Action alternative has been included in all analysis. These figures represent the potential employment and labor income for the wood products industry if the current situation continued into the future, using 2010 as the target year. All

income figures are presented in 1999 dollars to be consistent with previous information.

Estimates of direct and total employment and income for the wood products industry for each alternative are presented in Table 3-104. These estimates represent the projected annual employment and labor income in 2010.

Table 3-104: Estimates of annual wood products employment and income by alternative.

	No Action		Preferred		Alt A		Alt B		Alt C		Alt D		Alt E		Alt F	
Timber harvest (MMBF)	9.70		1.51		19.00		8.61		1.71		1.00		0.80		0.70	
	Direct	Total	Direct	Total	Direct	Total	Direct	Total	Direct	Total	Direct	Total	Direct	Total	Direct	Total
	average annual jobs															
Logging employment	30	36	5	6	59	71	27	32	5	6	3	4	3	3	2	3
Sawmill employment	54	65	8	10	106	128	48	58	10	11	6	7	4	5	4	5
Total employment	**153**	**203**	**24**	**32**	**300**	**398**	**136**	**180**	**27**	**36**	**16**	**21**	**13**	**17**	**11**	**15**
	average annual labor income in millions of 1999 dollars															
Logging labor income	1.43	1.60	0.22	0.25	2.80	3.13	1.27	1.42	0.25	0.28	0.15	0.16	0.12	0.13	0.10	0.12
Sawmill labor income	1.92	2.28	0.30	0.35	3.75	4.46	1.70	2.02	0.34	0.40	0.20	0.23	0.16	0.19	0.14	0.16
Total labor income	**8.40**	**11.45**	**1.31**	**1.78**	**16.45**	**22.43**	**7.45**	**10.16**	**1.48**	**2.02**	**0.87**	**1.18**	**0.69**	**0.94**	**0.61**	**0.83**

Source: MIG 1999.

In this analysis, the direct employment estimates represent those jobs supported by Forest timber harvest within the logging and sawmill sectors. Total employment estimates include direct employment and the indirect and induced employment associated with the wood products industry. Employment figures include all full-time, part-time and seasonal positions. These figures represent current jobs within the study area that will continue to be supported by Forest activity, as well as new positions created by additional wood products activity. Total figures include the Forest Service positions required to support and implement the timber program.

Average levels of employment per million board feet (MMBF) used in this analysis were based on the 1990-94 period of employment for logging and lumber in Southeast Alaska. This period includes both high levels of production in 1990 (resulting in low levels of employment per unit output) and significantly lower levels in the last two years. Consequently, the averages used here represent a fair estimate of the of employment per product output assuming no change in labor productivity, and that conditions in Southeast Alaska are similar to those in Southcentral Alaska. This assumption applies for the ten-year time horizon used in this portion of the analysis. In the long-term, however, increased labor productivity from technology gains could reduce the amount of direct jobs generated by a given level of output.

As would be expected, the higher the volume harvested on the Forest, the more employment that would potentially be supported within the study area. Given that the Forest has only been able to harvest 22 percent of its total sale offer in the past 20 years (see Table 3-83), the employment and income estimates assume a high market situation. A market situation typical of the past 20 years would reduce the employment and income supported by the timber program by roughly 80 percent. Even more unfavorable market conditions could reduce these levels to zero. Given these qualifications, Alternatives A, B and the No Action Alternative have significantly higher timber harvest levels, and therefore, more job and income opportunities than the other alternatives. Alternatives C, D, E, F, and the Preferred Alternative all have very limited commercial harvest, and most harvest would be a byproduct of forest restoration activities. In these cases, personal and free use would be a large component of the harvest and could support some small local logging, transportation, and portable sawmill operations.

The input/output economic model used for this analysis assumes fixed amounts of inputs for a given unit of output as well as fixed wages, so while average annual job figures change by alternative, the average annual salary is consistent among all alternatives. Table 3-105 highlights these annual labor income figures.

Table 3-105: Study area average annual labor income (1999 dollars) for the wood products industry.

Sector	Direct	Total
Logging	$47,170	$44,101
Sawmill	$35,420	$34,909
Total	**$54,790**	**$56,307**

While average logging income is significantly higher than sawmill income, both logging and sawmill direct jobs have higher average wages than the indirect and induced jobs associated with the wood products sector.

Input/output models and IMPLAN in particular, have certain limitations when used in this type of analysis. One is that input/output models represent the nature of an economy's interactions for a single period and it cannot represent or project dynamic changes that are occurring over a longer period of time. A second, especially pertinent to IMPLAN, is that IMPLAN is based on an aggregate input/output model for the United States economy, where these types of economic interactions are then calibrated for the local economy under analysis. These calibrations still retain the basic behavior of the parent national model that may not accurately represent the local conditions. The smaller the economy under consideration, the greater these problems are likely to be.

Current trends in the wood products jobs associated with Native corporation, other private and state harvests are not likely to be impacted by any alternative. In 1995, Native corporation, private and state timber harvest accounted for over 650 logging jobs. Native corporation harvest has been declining since 1995, and is expected to continue to decline (Brooks and Haynes 1997).

Salmon Harvesting and Processing. While it is recognized that there is some risk of fish habitat reduction over the next ten years, no significant change in commercial fisheries employment attributable to Forest activities is expected. This is due to the following reasons: (see Aquatic Ecosystems and Essential Fish Habitat Section of this chapter).

- New management activities should not cause additional degradation of freshwater fish habitat. Productive habitat will continue to be well distributed across the Forest. Habitats that are currently degraded will recover or be moving toward recovery. Riparian protection coverage in these watersheds will likely mitigate many effects of management activities on the fisheries resource.
- Site-specific risks to fish habitat, such as adverse effects of sedimentation from unplanned events such as road failures or washouts of culverts and bridges, the failure of culverts and bridges to pass fish, and stream bank damage from recreation use, increase with miles of roads, acres of ground disturbance, and intensive resource development. Differences between the alternatives in these factors are quite small. Over the next ten years such risks are likely to be localized and should not affect region-wide fish harvest.
- There is no production function to relate forest management activities to levels of fish produced and ultimately harvested.

Since we have assumed no significant impact over the next decade, we have not attempted to estimate employment or income associated with future commercial salmon fishing activity. The long-term industry trends will be played out beyond the direct control of Forest management.

Mining. No significant change in mining employment associated with Forest activities is expected under any of the alternatives over the next 10 years. This is due to the following reasons: (from the Minerals section of this chapter).

- Although the number of acres where mineral exploration and development are allowed varies by alternative, the amount of locatable minerals activity is expected to continue at about the same intensity as the past 10 years with 80 plans of operation across all alternatives.
- For leasable minerals, given the oil and gas potential and the level of industry interest in these resources on the Forest, it is unlikely that the Forest will see any significant oil and gas leasable activity in the near future. Similarly, development of coal resources seems unlikely.
- Salable minerals may be sold for fair market value or disposed of through free use in any of the alternatives. This category is widely available across the Forest. Although some prescriptions would

not allow the extraction of salable minerals, none of the alternatives would result in significantly affecting the supply since there are large volumes of these minerals on private and state lands that could meet public needs.

Long-term opportunities for employment in hardrock minerals activity could be affected by the alternatives that withdraw areas of mineral potential through Wilderness designation. Tables 3-95 and 3-96 compare the long-term minerals availability of the alternatives. Alternative A retains nearly all long-term mineral development opportunities. Alternatives B and C retain approximately 80 percent of these opportunities including 95 percent of the most favorable identified resources. The Preferred Alternative and the No Action Alternative retain 60-70 percent of these opportunities including 90 percent of the most favorable identified resources. With increasing amounts of Wilderness, Alternatives D, E and F respectively retain lesser amounts of these opportunities with roughly 60 percent, 47 percent and 19 percent of the potential opportunities and 85 percent, 70 percent, and 66 percent of the most favorable identified resources.

Payments To The State

As outlined earlier in this section, commercial use of the national forest results in a payment to the boroughs or local communities surrounding the Forest. Of the total revenues taken in by the Chugach from commercial uses including timber sales, recreation special use permits, minerals, power, and other commercial land uses, 25 percent is paid back to boroughs and census areas based on acreage of National Forest System lands within their boundaries. These payments are to be used specifically for local roads and education.

In the short term payments to local governments are expected to be constant for the next few years. This is a result of legislation passed in 2000 that guarantees a set payment level for a limited period of time. (Secure Rural Schools and Community Self Determination Act of 2000).

In the long term without further adjustment of legislation, alternatives that increase or encourage commercial uses and operations would result in higher payments to the state. Those alternatives that allow more commercial recreation and tourism development and use, or those alternatives with higher commercial timber harvest levels would result in larger payments. Mineral development is likely to be the same in all alternatives. Commercial fishing and a large portion of the sport fishing use would not add revenues to the Forest Service. Alternatives A, B and C have some potential to substantially increase these payments. The No Action Alternative, Preferred Alternative, and Alternative D would probably maintain the current levels of payments. Alternatives E and F may lead to some reduction of payments, at least in the short term, as some permittees may be required to terminate or severely modify their existing operations.

Economic Efficiency Analysis

Efficiency analysis seeks to measure all of the costs and benefits associated with a given planning alternative and summarizes them in the form of a "Present Net Value" (PNV). In deriving PNV figures, costs are subtracted from benefits to

yield a net value. "Future values" (i.e., benefits received in the future) are discounted using an appropriate discount rate to obtain a "present value." The PNV of a given alternative is the discounted sum of all benefits minus the sum of all costs associated with that alternative. Following Forest Service standard procedures, a four percent discount rate is used.

In the following analysis, we have provided quantitative PNV estimates for the timber program. For reasons discussed below no attempt was made to estimate PNV values for commercial fishing, mining or recreation and tourism. Neither are the PNV of nonuse (or "passive use") values or opportunity costs quantified. Nonuse or passive use values represent societal values associated with maintaining the existence of certain characteristics associated with natural environments or to maintain future options to either for preservation or development of the same environment. Opportunity costs represent the PNV foregone by not developing an area for certain economic benefits. Given the difficulty of estimating PNV for fishing, mining and recreation and tourism, there is no practical way to estimate the opportunity cost. This cost is the PNV foregone by not developing an area.

Although estimates of the expected financial costs are provided in Chapter 2, they do not vary significantly between the alternatives. An inability to identify differences in output production and an inability to quantify the value of the benefits means that any calculation of PNV would not provide meaningful information to distinguish between the alternatives. Given that the only output with varying production levels between the alternatives is timber, only timber has PNV estimates across the alternatives. The inability to estimate significant differences among the other major uses: recreation, fishing, or mining means that an integrated PNV for the alternatives cannot be done. A discussion of the situation of each of these resources follows. The nonuse values are qualitatively discussed in both the local preferences and national interests sections that follow under social effects

Timber. PNV estimates for timber for the three alternatives that have commercial timber harvests are presented in Table 3-106, and the derivation of these estimates is detailed below.

Table 3-106: Present net value for timber.

Alternative	Present Net Value (Millions of 1999 dollars)
No Action	6.71
A	16.43
B	5.84

Alaska's timber producers are price-takers with no significant ability to impact prices for timber in national and international markets. Volumes produced by the region are comparatively small and, unlike the Pacific Northwest, a large reduction in Alaska harvests would not be expected to have a significant impact on lumber prices in the consuming regions. In this PNV calculation net timber program return is equal to pond log value in a high market minus total logging

and marketing costs and timber program management cost (includes harvest administration costs, road maintenance costs, site preparation and reforestation costs). Net timber program revenues were calculated for the next 50 years. Future revenues were discounted at four percent using 1999 as a base year and assuming full implementation of the given alternative beginning in 2001. All estimates are based on the assumption that the high market allowable sale quantity (ASQ) is harvested. A low market assumption would lead to a situation where the PNV associated with timber might lead to a failure to harvest these trees with a negative PNV as a result of the administrative costs incurred. The actual PNV would be likely to occur between a negative estimate and the estimate provided in Table 3-106.

Salmon Harvesting and Processing. No PNV estimates for the commercial salmon industry were undertaken for this report. There are three main reasons for this omission. First, no quantifiable variation in estimates of projected catch is available for the planning alternatives. If impacts do occur they are not expected to affect the aggregate catch. The second reason is that the ability to prepare a forest based cost-production function does not exist. With no variation in either the production levels of salmon resulting from the Chugach or any ability to cost these different production levels, there is no ability to project changes in costs, outputs or benefits.

Mining. Estimates of mining PNV also were omitted from this analysis. Since mining activity is not projected to vary significantly by alternative, this omission will have no substantive effect on the results. Moreover, estimates of PNV for mineral deposits will vary greatly with current and future mineral prices. To attempt a PNV estimate for this industry was felt to be inappropriate within the context of this analysis.

Recreation and Tourism. Estimates of PNV also were not calculated for recreation. The major reason for this is that the total amount of recreation use does not vary between the alternatives. This consistency includes an assumption that there will be no difference between the alternatives for all of the various recreation activity types. The only variation that has been identified is the partition of this total level of dispersed recreation between wilderness and nonwilderness.

Nonmarket values for recreation opportunities have remained a consistent source of controversy. There have been values identified for different types of recreation, including different values for wilderness and nonwilderness recreation. However, applying these recreation values to suggest differences in the economic value of recreation between the alternatives without an analysis that also clearly differentiates the production of this recreation would lead to a determination of PNV based solely on these differences in nonmarket values.

Application of such differential values without more detailed information in the anticipated levels of recreation use and activities is not an adequate basis for a reasonable estimation of economic efficiency.

Social Effects

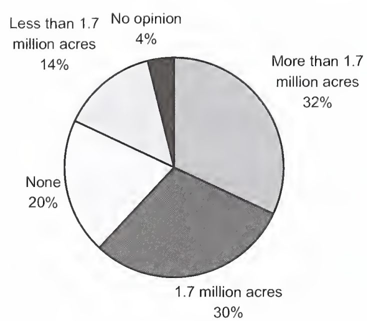
Local Preferences

In this section, the alternatives are compared in terms of how well they reflect the preferences, interests, or desired outcomes of local citizens as expressed by their responses to the two community surveys discussed in the affected environment section. This approach is inherently subjective and carries with it the implicit assumptions that the survey respondents were a well informed and representative random sample of the local public, who understood the questions, asked and responded in a truthful manner. Despite these caveats, the sample results provide a better metric of the interests of the general local public than is usually available in the Forest Plan revision process. All survey percentages reported are based on a pooled sample of all Forest communities of interest respondents.

Wilderness

Figure 3-87 displays community residents' preferences regarding the amount of Wilderness that should be recommended in the Revised Forest Plan.

Figure 3-87: Preference for the amount of designated Wilderness.



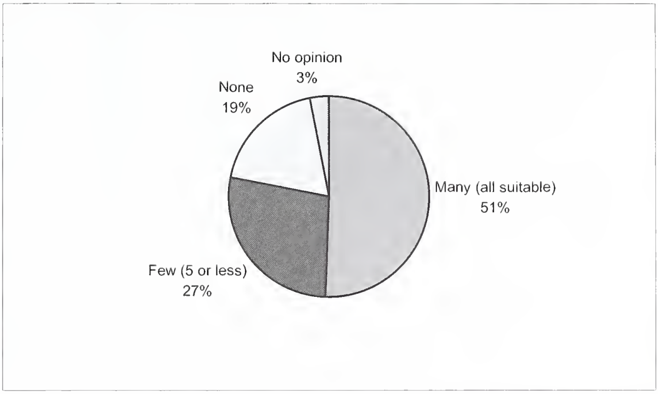
Source: "Planning for the future of the Chugach National Forest", Alaska Pacific University, 1998.

Based on the recommended Wilderness acreage totals presented in the Wilderness Section of this chapter, the Preferred Alternative, the No Action Alternative and Alternative D, appear to most closely match local public preferences. Alternatives A, B, and C probably do not recommend enough Wilderness acreage, given that 62 percent of the respondents preferred 1.7 million acres or more. Similarly, Alternatives E and F probably recommend too much Wilderness acreage, given that 64 percent of the respondents preferred 1.7 million acres or less.

Wild and Scenic Rivers

Figure 3-88 displays community residents' preferences regarding the amount of Wild and Scenic Rivers that should be recommended in the Revised Forest Plan.

Figure 3-88: Preference for the amount of designated Wild and Scenic Rivers.



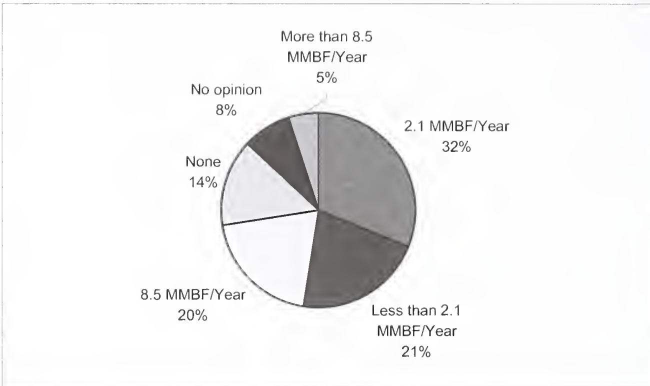
Source: "Planning for the future of the Chugach National Forest", Alaska Pacific University, 1998.

Based on the recommended Wild and Scenic Rivers totals presented in that section of this chapter, Alternatives D, C and the Preferred appear to most closely match local public preferences. The No Action, A and B Alternatives probably recommend too few Wild and Scenic Rivers, given that 51 percent of all respondents preferred that many (all suitable) rivers be recommended. Similarly, Alternatives E and F probably recommend too many Wild and Scenic Rivers, given that 48 percent of all respondents preferred that 5 or fewer rivers be recommended.

Timber Harvest

Figure 3-89 displays community residents' preferences regarding the amount of timber harvesting that should be allowed in the Revised Forest Plan.

Figure 3-89: Preference for the amount of timber harvest.

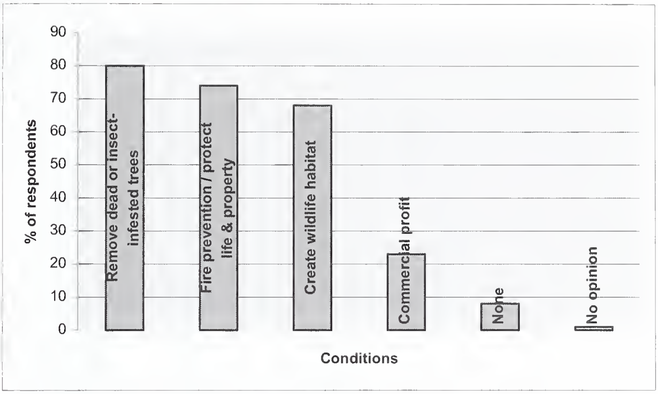


Source: "Planning for the future of the Chugach National Forest", Alaska Pacific University, 1998.

Based on the total timber program quantities (assuming a high market and the full-funding level) reported in the timber section of this chapter, Alternatives D, B and the Preferred appear to most closely match local public preferences. Alternative A and the No Action Alternative probably allow too much timber harvest, given that 67 percent of all respondents preferred harvests of 2.1 MMBF or less. Similarly, Alternatives E and F probably allow too little harvest, given that 57 percent of all respondents preferred harvests of 2.1 MMBF or more.

Figure 3-90 displays community residents' feelings regarding acceptable conditions for timber harvesting. Only Alternatives B, A and the No Action Alternative have harvests specifically for commercial profit. All other harvests are for the removal of dead or insect infected trees, for fire prevention or the protection of life and property and may be part of the free or personal use program. No harvests are planned specifically for the creation of wildlife habitat.

Figure 3-90: Acceptable conditions for timber harvest.

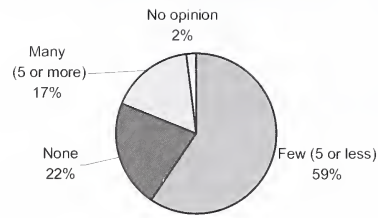


Source: "Planning for the future of the Chugach National Forest", Alaska Pacific University, 1998.

Roads

Figure 3-91 displays community residents' preferences for the amount of new roads to be constructed on the Forest in the next 10-15 years. Since no definition was given in the survey as to what exactly was meant by the term road (e.g., a 30-mile paved road or a 0.1-mile gravel spur road), it is very difficult to evaluate the alternatives in this regard. The number of new road miles by the end of the first decade under Alternatives A, B, No Action, the Preferred, C, D, E, and F are 113, 81, 66, 32, 29, 22, 16 and 13 respectively. Most of these roads are very short and would be built to provide access to new recreation facilities such as campgrounds, trailheads and day use sites.

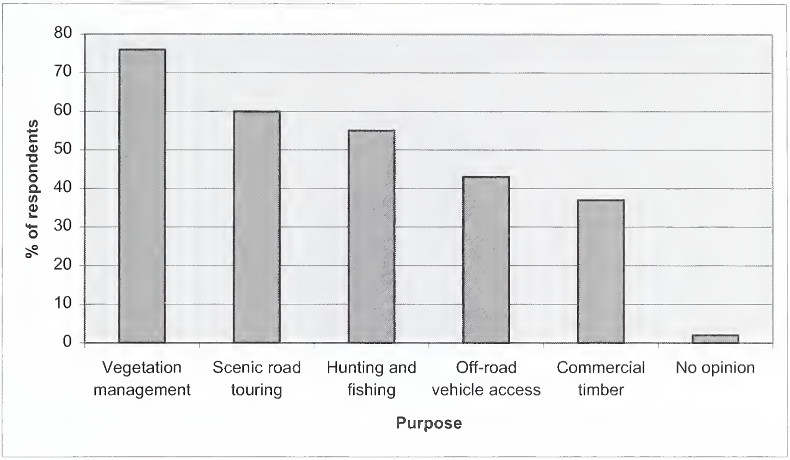
Figure 3-91: Preference for the amount of new roads.



Source: "Planning for the future of the Chugach National Forest", Alaska Pacific University, 1998.

Figure 3-92 displays community residents' feelings regarding acceptable conditions for new road building on the Forest.

Figure 3-92: Acceptable purposes for road construction.



Source: " Planning for the future of the Chugach National Forest", Alaska Pacific University, 1998.

The annual average new road miles associated with access to new recreational facilities over the next 10 years for Alternatives A, the Preferred, B, C, D, No Action, E, and F are 3.2, 3.2, 3.1, 2.8, 2.2, 1.6 and 1.3. The annual average new road miles associated with timber harvest over the 10 years for Alternatives A, No Action and B is 8.1, 4.4, and 3.4 respectively. The other alternatives have no new roads associated with timber harvest. Alternative B would also construct 1.6 miles/year to improve access to the Forest. There are no other plans to build roads for the specific purposes of vegetation management, scenic road touring, hunting and fishing, or off-highway vehicle access, although once built most of the roads built for other purposes could be used for these purposes.

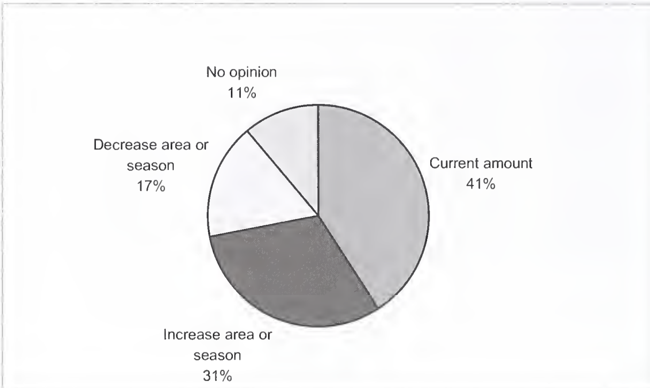
Snowmachine and OHV use.

Figure 3-93 displays residents' preferences for the amount of the Forest that should be open for snowmachine use.

At the end of the first decade, the miles of trail available for snowmachine use in Alternatives B, A, the Preferred, C, E, F, D and No Action are 686, 639, 639, 573, 452, 426, and 361, respectively. All Alternatives have more than the current amount of trails available for snowmachine use. The amount of acres (in thousands) on which snowmachine use is allowed in Alternatives A, F, E, D, B, the No Action, C, and the Preferred is 5,387, 5,109, 5,032, 4,848, 4,719, 4,709,

4,432, 4,226, and 2,342, respectively. The No Action Alternative represents the current amount of acres available, thus all alternatives except D, C and the Preferred have more area open then the current amount open. Not all areas are open for use for the same amount of time in all alternatives, but acreage-season length totals have not been calculated.

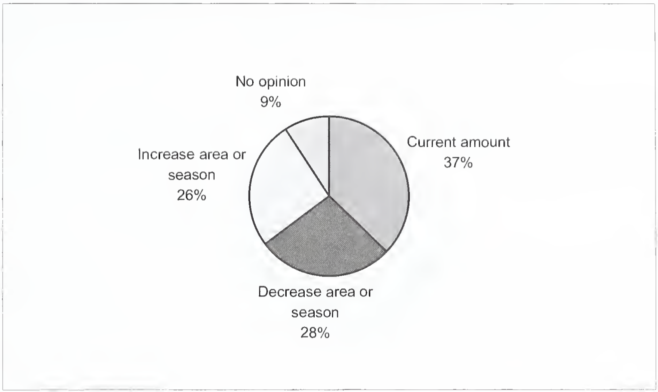
Figure 3-93: Preference for open areas for snowmachine use.



Source: " Planning for the future of the Chugach National Forest", Alaska Pacific University, 1998.

Figure 3-94 displays residents' preferences for the amount of the Forest open for OHV use.

Figure 3-94: Preference for open areas for off highway vehicles.



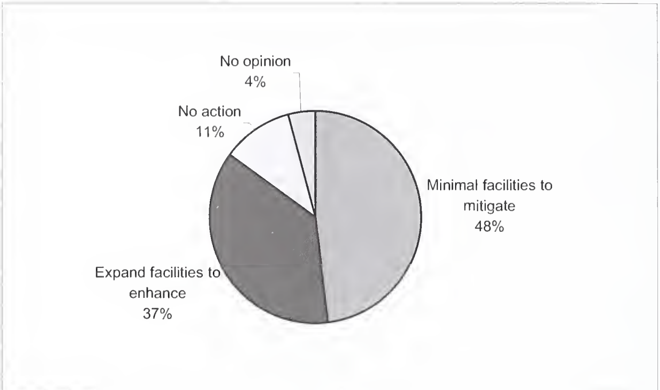
Source: "Planning for the future of the Chugach National Forest", Alaska Pacific University, 1998.

At the end of the first decade, the miles of trails available for winter motorized use would be: Alternative B, 954; Alternative C, 944; Alternative D, 874; Alternative A, 868; the Preferred Alternative, 868; Alternative E, 758; the No Action Alternative, 737; and, Alternative F, 692. At the end of the first decade, the miles of trail available for summer motorized use would be: Alternative B, 282; Alternative C, 135; Alternative A, 77; the Preferred Alternative, 77; the No Action Alternative, 52; Alternative D, 9; Alternative F, 7; and, Alternative E, 6. The amount of acres (in thousands) on which winter motorized use is allowed would be: Alternative A, 5,386; Alternative B, 3,744; the No Action Alternative, 2,777; Alternative C, 1,720; the Preferred Alternative, 1,290; Alternative D, 1,171; Alternative E, 967; and, Alternative F, 487. The amount of acres (in thousands) on which summer motorized use is allowed would be: Alternative A, 5,387; Alternative F, 4,897; the Preferred Alternative, 4,831; Alternative B, 4,639; Alternative E, 4,616; the No Action Alternative, 4,442; Alternative D, 4,116; and, Alternative C, 4,028.

Response to Whittier Road

Figure 3-95 displays respondents' preferences for Forest management response to the Whittier access road to Prince William Sound.

Figure 3-95: Preference for management response to the Whittier road.



Source: "Planning for the future of the Chugach National Forest", Alaska Pacific University, 1998.

Based on the prescriptions within a "day use" radius of Whittier, the level of facilities development allowed in Alternatives E, F, No Action, the Preferred, C, B, and A is few, few, low, low, moderate, high and high, respectively.

Quality of life factors affected by public land management.

This section evaluates the alternatives in terms of effects on the five public land factors rated most important to survey respondents' quality of life.

1. Clean air and water.

   Air - In terms of risks to clean air associated with prescribed fires, the ranking of alternatives from least to highest risk is: E, F, D, the Preferred, C, No Action, B, and A. In terms of risks to clean air associated with unpaved roads, the ranking of Alternatives from least to highest risk is: F, E, D, the Preferred, C, No Action, A, and B. In terms of risks to clean air associated with unpaved roads, the ranking of Alternatives from least to highest risk is: E, F, the Preferred, D, No Action, C, A, and B. Despite these relative risk ratings, all areas on the Forest are currently in compliance with National Ambient Air Quality Standards, and none of alternatives would substantially change the existing air quality on the Forest.

   Water - The ranking of alternatives in terms of risk of adverse cumulative effects to the water resource are from least to highest risk: F, E, D, the Preferred, C, No Action, B and A.

2. Beauty of the surrounding area.

   Based on the information presented in the Scenery section of this chapter the ranking of the alternatives in terms of the percentage of total acres in the High or Very High Scenic Integrity Objective (SIO) classes is (from highest to lowest): F, E, D, the Preferred, C, B, No Action, and A.

3. Open, undeveloped areas.

   Using the amount of acreage in Category 1 prescriptions as a proxy for the potential amount of open, undeveloped areas, the alternatives are ranked as follows (from highest to lowest amount of acreage): F, E, D, the Preferred, No Action, C, B, and A.

4. Access/use of nearby public lands.

   In terms of total Forest acres available for any to all noncommercial uses the ranking of the alternatives is (from most to least): A, B, No Action, the Preferred, C, D, E, and F. This same ranking holds for total Forest acres available for any to all noncommercial and commercial uses.

   As discussed in the Access Management section of this document, a key element for nonmotorized access is the ease in getting to a nonmotorized area. Alternative D and the Preferred would provide the most nonmotorized opportunities near existing access and communities.

5. Local recreational trails.

   As presented above the ranking of alternatives in terms of total trail miles available for winter and/or summer use at the end of the first decade is (from most to least): C, B, D, the Preferred, A, E, No Action and F.

Public uses of the Forest
This section evaluates the alternatives in terms of effects on the five public uses of the Forest that survey respondents most favored.

1. Fish and wildlife habitat.

   <u>Fish habitat</u> - (From the Fish Habitat section) In terms of the potential risk of site-specific adverse effects to fish habitat the ranking of alternatives is (from least to most risk): F, E, D, the Preferred, C, No Action, B and A. However, productive habitat is predicted to continue to be well distributed across the Forest, or the historic range of the species within the Forest, under all alternatives.

   <u>Wildlife habitat</u> - (From the Wildlife Habitat section) All alternatives represent a low level of risk to maintaining viable populations of wildlife. Habitat is of sufficient quality, distribution, and abundance

to allow the species to maintain breeding populations distributed across the Forest. However, some local populations are more ephemeral because of reduced population levels and increased susceptibility to environmental extremes and stochastic (random) events associated with reduced habitat abundance and distribution. Vacated habitats may become recolonized in the future.

2. Camping and picnicking.

   Based on historic Forest recreational use data, 75 percent of camping and picnicking visits are estimated to take place in dispersed or undeveloped settings while 25 percent are estimated to occur in developed sites. The amount of dispersed visits is predicted to be the same across all alternatives, while the amount of developed visits is predicted to be constrained by the available capacity. The ranking of alternatives in terms of developed capacity at the end of the first decade is (from highest to lowest): B, A, C, No Action, D, the Preferred, E, F.

3. Nonmotorized recreation.

   (From the Recreation section of this document). Alternatives A and B offer the most modified settings and emphasize more motorized activities. Alternatives E and F offer the least modified settings and emphasize more nonmotorized activities. The Preferred and Alternatives C and D are in the middle.

4. Wildlife viewing.

   Based on historic Forest recreational use data, 70 percent of wildlife viewing is estimated to occur in dispersed areas while 30 percent is estimated to occur at developed sites. Again, the amount of dispersed visits is predicted to be the same across all alternatives, while the amount of developed visits is predicted to be constrained by the available capacity. The ranking of alternatives in terms of developed capacity at the end of the first decade is (from highest to lowest): B, A, C, No Action, D, the Preferred, E, F.

5. Gathering forest products.

   The amount of acreage on which forest products can be gathered is the same across all alternatives. Since only 6 percent of forest products gathering visits are estimated to occur at developed sites, the amount of developed capacity is probably not a limiting factor for this activity.

Overall Alternative Compatibility with Ecosystem Values

Using a specially designed and detailed experimental modeling process, each management alternative was subjectively but consistently analyzed and rated in terms of its overall compatibility with ecosystem values. (The ecosystem values included (based on Rolston 1988): recreation, life support, aesthetic, biological

diversity, future, economic, subsistence, therapeutic, intrinsic, learning, historic and cultural.)

The multi-step process to estimate compatibility utilized a systematic combination of public opinion of (1) the importance and (2) geographic distribution of ecosystem values throughout the Forest (obtained from survey respondents) and ID Team estimation of (3) whether a management activity would adversely or beneficially affect the ecosystem values and (4) how much it would be emphasized in the prescription. Due to the nature of the survey, the process addressed compatibility at the watershed management scale rather than the planning unit scale.

Because each management alternative is a unique combination of management prescriptions across management units, it was possible to estimate (1) the "best fit" combination of management prescriptions for each management unit as well as (2) the differences in the overall compatibility of all alternatives considered. Each alternative was rated on a standardized scale from 0 to 100 percent, where 0 indicated the least compatible with ecosystem values and 100 the most compatible. (Thus, the ratings were more relative than absolute. The only alternative that could be assured to score 100 would be an idealized ("best fit") one where each management unit in the alternative was assigned the management prescription determined by the process to be most compatible.)

Of the alternatives considered, the No Action Alternative was rated highest in terms of overall compatibility with ecosystem values with a score of 80 percent, followed in order by Alternative B (79 percent), Alternative C (74 percent), Alternatives A, E, and F (70 percent), and Alternative D (69 percent). The Preferred Alternative compatibility score was 74 percent. The relatively small variation observed in the range of alternative compatibility scores suggest that the distribution of ecosystem values was (1) diverse and/or (2) that a number of management prescriptions were more or less equally compatible when combined at the alternative scale.

Community Resiliency, Subsistence and Environmental Justice

Community Resiliency--As stated above changes in land management policies may have greater or longer lasting effects on less resilient communities. Of the five communities with the lowest resiliency scores Kenai, Soldotna, Sterling, and Valdez had the highest populations (excluding Anchorage) in 1998 and also had some of the highest median incomes in the study area in 1990. The low resiliency scores in these communities are driven by lower regional amenity, civic leadership and social organization ratings rather than by economic structure problems. It is unlikely that any of the alternatives would affect these communities in ways that would lead to decreasing resiliency in the future.

Whittier, which had both the lowest community resiliency and quality of life score, is also the community likely to face the greatest change in the near future. This change is driven by the opening of the new road to Whittier, which will occur regardless of the alternative chosen. Alternatives that allow for at least some expansion of facilities on the Forest to accommodate the increased use of areas

near Whittier would probably mitigate some of the congestion and associated problems this community will endure as both locals and tourists funnel through the area.

Subsistence -- The opportunity to participate in subsistence activities reinforces a variety of cultural and related values in both Native and non-Native communities. Distribution of fish and wildlife contributes to cohesion of kinship groups and to community cohesion through the sharing of resources derived from harvest activities. Subsistence resources play an important role in the ceremonies and social and religious traditions of Alaska Natives. "Human survival, the economy and the means of establishing prestige and maintaining peace have all involved the consumption, transfer, and exchange of fish, game and of products made thereof, since time immemorial" (Brown and Burch 1992).

Most subsistence communities have mixed cash-subsistence economic systems in which residents divide their time between participation in wage earning activity and subsistence activity. This situation provides a means to estimate the economic value of subsistence activity by examining the trade-off in terms of wage earnings foregone when individuals engage in subsistence activity. Using this approach, Wolfe and Walker (1987) estimated a trade-off of about $118 (1982 dollars) per pound of subsistence harvest. Duffield (1997) compared the results from this hedonic approach to that from an application of the Brown-Burch model in which he used market replacement price as a proxy for market value and travel cost-based recreational sport fishing value as a proxy for the activity value of participation in subsistence hunting and fishing to estimate damages to subsistence users from the *Exxon Valdez* oil spill. Both methods yielded estimates of a similar magnitude.

The Subsistence section in this chapter concluded that there would be no significant restrictions to subsistence activities in any of the alternatives. Since reliable estimates regarding possible variations in the pounds of subsistence resources harvested by alternative are not possible, it is not possible to quantitatively evaluate the alternatives in terms of subsistence values. However, general results from Wolfe and Walker suggest that subsistence productivity increases with distance from population centers, decreases with road access, and decreases as the percentage of non-Natives increases in a community's population.

Environmental Justice -- Within a socioeconomic context, ecosystems are viewed as providing a wide variety of goods and services that enhance well-being and benefit a range of human wants and needs. Federal natural resource policy is expected to not only provide economic opportunities, but also to maintain our natural and cultural heritage. Some of these expectations have been expanded in the last five years by the growing interest in environmental justice (see Salazar 1996 and Weinberg 1998). These concerns have resulted in an Executive Order (number 12898) that requires federal agencies to analyze the environmental effects, including human health, economic and social effects of their actions on minority communities and low-income communities, addressing

instances where the effects on these communities may be disproportionately high and adverse.

Environmental justice as it relates to land management issues is described by Salazar (1996) as a melding of concerns for environmental protection, democracy, and social justice. Social justice issues include fair procedures to allocate natural resources, fair distribution of the benefits and costs of resource management and equal access to public resources. Salazar believes an important tenet of the environmental justice movement is the notion that environmental issues must be considered within their political economic context, that status and power are key determinants of the quality of a person's environment, and that a person's status and power are influenced by his/her social class and skin color.

To evaluate the alternatives in terms of environmental justice, the following factors were used to determine Forest communities of concern: employment diversity score, percentage of households below poverty level, median household income, the percentage of the population that is Native, the civilian unemployment rate and the percentage of adults not in the labor force. Using these criteria the communities of Chenega Bay, Tatitlek and Hope are areas where environmental justice effects might occur. These three communities had the lowest median household income in 1990 and each has subsistence preference. Based on the results from the Wolfe and Walker study much of the lower income levels in these three areas may be a reflection of the higher value community members place on engaging in subsistence activities rather than wage-earning activities as evidenced by the high amount of subsistence use in these areas (especially Tatitlek and Chenega Bay). This being said alternatives that result in lower subsistence resources in these areas could result in effects on these communities that are disproportionately high and adverse. Efforts have been made to gather comments from these communities and keep them involved in the planning process through both formal consultation with the Native leaders of Chenega Bay and Tatitlek and public meetings held in all three locations.

National Interests

Peterson and Brown (1999), write:

> Because of market failure and imperfection, inclusion of information about non-market factors in forest management decisions is absolutely essential. The state of the art for accomplishing this end is also imperfect and controversial, however, and we must not pretend that the economic paradigm is or ever will be the ultimate decision machine. The economic approach is just one of several important but imperfect information systems that offer useful advice to managers who must, nevertheless, make decisions not as omnipotent and omniscient kings, but mere participants in a complex process of political conflict resolution filled with risk and uncertainty. . . .

> The limitations of economics include institutional incentives beyond the manager's control, implicit political assumptions that are not universally acceptable, inability to measure some important values in economic terms, questions about the validity and credibility of measured values, failure of consumer sovereignty to serve long-term human welfare, and failure of economics to account adequately for intergenerational values. Further, controversy surrounds available methods for measuring non-market values, such as the contingent valuation method, and the cost of application often exceeds the cost of being wrong.

The authors go on to state that while credible and valid monetary valuation of all non-market values is not possible, forest managers need to pay attention to the economic information system when the cost of the information does not exceed the cost of being wrong, while at the same time paying attention to complimentary information systems that look at non-market factors in non-monetary terms.

In light of these remarks, no attempt is made here to empirically estimate the market and non-market values associated with the flow of goods and resource services emanating from the Forest under each of the alternatives. Instead the results of two studies designed to measure some of the values society at large places on Alaska natural areas are summarized as an indication of the magnitude of these values. Next, two general results from other studies that are likely to apply to Alaska are mentioned. This is followed by a discussion of the probable opportunity costs and changes in use and nonuse values associated with making areas on the Forest Wilderness versus placing them under other management prescriptions. Included here is an interpretation of what wilderness advocates and nonwilderness advocates are revealing regarding both their risk attitudes and their trust of Forest managers.

Estimates of national values for Alaskan natural areas – Walsh and others (1996) surveyed a national sample of 380 households regarding the amount of natural area they would like to see protected in each of five regions of the nation, including Alaska. Respondents were also asked the maximum annual amount of money they would be willing to pay to preserve these areas. The average amount of natural area respondents wanted protected in Alaska was 88.5 percent of all natural area in the state. The average annual amount of money respondents were willing to pay to protect natural areas in Alaska was $61.74 (1994 dollars). This average amount was higher than respondents were willing to pay to protect natural areas in any other region of the nation. The amount of natural area in Alaska is much greater than the amount remaining in other areas and no estimates were made of willingness to pay on a per acre basis. However, the authors did find that as more natural areas are designated for protection, the willingness to pay for additional area decreases in each of the five regions.

Respondents were also asked to rate the quality of the natural areas in the region where they live and other regions according to a 5-point scale, with (1) very low quality, (2) low, (3) medium, (4) high, and (5) very high, for 13 attributes

and services. For 12 of the 13 attributes, respondents rated the quality of natural areas in Alaska significantly higher than areas in other regions. The only exception was with respect to convenient location and accessibility (2.98), for which all other regions rated higher. Alaska quality was rated highest in: providing scenic beauty of a natural landscape unaltered by man (4.31); protecting rare and endangered species (4.28); knowing that future generations will have natural areas (4.21); protecting air and water quality (4.17); knowing natural areas exist for their own sake (4.12); knowing that in the future they have the option to go there if they choose (4.02); conserving natural areas for education and scientific study (4.00); preserving unique plant and animal ecosystems and genetic diversity (3.96); providing uncrowded hiking, camping, fishing, hunting, wildlife viewing, etc. (3.88); providing jobs and income from the tourist industry (3.69); and providing spiritual inspiration (3.42). Although, only 10 percent of the respondents reported they had ever been to natural areas in Alaska, 82 percent expressed interest in seeing Alaskan natural areas in the future.

Carson and others (1992) used a nationwide contingent valuation survey of 1,043 households to estimate the loss of passive use values resulting from injuries to natural resources caused by the *Exxon Valdez* oil spill. They estimated that the median household willingness to pay for a plan to prevent such a spill in this area in the future was $31. Multiplying this estimate by the number of English speaking U.S. households in 1992 (this was the population sampled) resulted in an estimate of passive use losses of $2.8 billion dollars (1992 dollars).

Brown (1993) reviewed 31 contingent valuation studies, conducted between 1980 and 1993, in which nonuse values were estimated. He found that respondents in most studies indicated that nonuse value exceeds use value. Further, several studies found that nonuse value was higher for users of the good than for nonusers of the good, which suggests that basing nonuse value solely on the responses of nonusers will underestimate nonuse value.

Wilderness versus nonwilderness prescriptions -- Wilderness designation in Alaska differs from this designation in other areas because ANILCA provides for motorized access and mechanized equipment related to traditional activities, subsistence activities, equipment use related to the taking of fish and wildlife, and administrative needs and activities. Subject to existing rights on valid claims, Wilderness would be withdrawn from all forms of mineral entry. Timber harvest is not allowed, however the amount of suitable acres for timber harvest is small. As detailed in the Wilderness Section of this chapter, the biggest foregone opportunity would be the exploration and development of mineral resources. At this time the mineral potential of much of the Forest is unknown.

To estimate the opportunity cost of placing areas under less protective management prescriptions, we need to understand the effects of these prescriptions on both the use and nonuse values people attach to wilderness. Results presented in other sections of this chapter suggest that even in the alternatives that allow the greatest development opportunity, the risks to clean air

and water, biodiversity, viable populations of plants and animals, scenery, opportunities for primitive recreation experiences and other use and nonuse services are small. In terms of supply, as stated in the Wilderness Section of this Chapter, the Forest is almost surrounded by lands that are managed for their wilderness or roadless values. While the Copper River Delta is truly a unique area, this area has already been congressionally recognized as an area to be managed for its fish and wildlife. In the opinion of the ID Team wildlife biologist more protection is afforded potentially sensitive species under some nonwilderness prescriptions, because under Wilderness designation management activities to improve the viability of these species could not be undertaken until after they were listed as Threatened, Endangered or Sensitive. The de facto amount of ecosystem protection associated with nonwilderness prescriptions on the Forest is probably higher than in other areas of the country because of the remoteness, difficulty of terrain, and shortness in seasons of use. In summary, although none of the Forest has yet been designated Wilderness, most of the Forest retains wilderness-type attributes.

Risk Behavior. In most areas, if the past is any prediction of the future, little development is likely to occur on the Forest regardless of the prescriptions applied. Based on the current situation, the opportunity costs associated with either a Wilderness designation or a nonwilderness prescription are not great for most areas on the Forest. What advocates on either side of the issue are probably revealing are their attitudes towards risk and their trust, or lack thereof, in Forest managers. Uncertainty regarding mineral deposits, future mineral prices, technological improvements, population increases and associated increases in tourists and recreational users, as well as the possibility of political changes and future restrictions on traditional and subsistence use in areas designated as Wilderness contribute to risk adverse behavior by nonwilderness advocates. These same types of uncertainties, as well as those associated with the effects of increased activity on the functioning of ecosystem processes and the resources and species (including humans) that depend on these processes lead wilderness advocates to adopt the same risk adverse behavior.

Barker (1994) writes, “From their inception, policies regarding national forestry have been set by the social values of the day, not by foresters and forest science.” Bengston and Fan (1999) add, “Developing a policy that more accurately reflects current and emerging social values would be enormously simplified if there were widespread agreement about those values.” With regards to the Revised Forest Plan, in choosing an alternative the decision maker will inevitably make some groups and individuals better off and others worse off in terms of their perceived values from the decision. Hopefully, the information presented in this section will be helpful in evaluating the trade-offs to be made from a social and economic perspective.

Potential Conflicts with Goals or Objectives of Other Agencies and Landowners

The Forest has coordinated with various agencies the development of goals, objectives, standards and guidelines, formulation of alternatives and other important aspects of the revision process. Consultations include Native Alaskan tribes; Alaskan Native corporations; the Bureau of Land Management; U. S. Geological Survey; Environmental Protection Agency; U.S. Fish and Wildlife Service; Alaska Departments of Fish and Game, Natural Resources, and Transportation and Public Facilities; and, other local, state, and federal agencies. Many of these agencies and corporations participated in the open Interdisciplinary Team meetings throughout the process. The administrative record, located at the Forest Supervisor's Office in Anchorage, Alaska, contains proceedings of each of the coordination efforts.

The alternatives, associated effects, Forestwide standards and guidelines, and management area prescriptions are generally compatible and complement the goals and objectives of land management agencies and land owners within or adjacent to the Forest. The following summary is provided to help define areas of potential differences between the Forest Service policies, management, and responsibilities and those of other agencies.

- Mitigating effects from mining activities could result in conflicts with federal mining laws. The U.S. Mining Laws predate all other laws that govern Forest Service activities. Conflicts could arise between the mining activities allowed under the act and other resources, such as scenery, natural quiet, water, sensitive plants and animals, or recreation.
- The USDI expressed a concern that management area prescriptions along the Kenai National Wildlife refuge adjacent to the Minimal Management and Wilderness Zone boundaries be changed to Recommended Wilderness and Primitive Management Area prescriptions. This was not done. Management area prescriptions under the Revised Forest Plan include:

  132 – Wild Rivers

  210 – Backcountry

  242 – Brown Bear Core Area

  244 – Fish and Wildlife Conservation Area

  312 – Fish, Wildlife, and Recreation

  314 – Forest Restoration

  521 – Minerals (mining claims with approved Plans of Operations)

- The State of Alaska was concerned with any reference to tideland areas, which are owned by the state (see Chapter 6, Lands).
- The Forest worked with the State of Alaska Department of Parks and Recreation to coordinate planning efforts in Prince William Sound concerning State Marine Parks and location of float lodges. Efforts were made to coordinate management of the uplands with the marine environment. There could be continuing conflicts with respect to motorized recreation and float lodges.
- Access to private inholdings within the Chugach National Forest by Alaska Native regional and village corporations will be affected by management area prescriptions. Concerns were expressed that areas recommended for Wilderness designation would block access to private land. The Forest carefully reviewed all areas recommended for Wilderness to insure that nonwilderness access was provided to all private lands. Concerns were expressed that rivers recommended for classification under the Wild and Scenic Rivers Act could prevent access to private lands. The application of the Scenic or Recreational River Prescription would require additional analysis/permitting in the future, however they would not prevent or deny access. The application of the Wild River classification could prevent access across the designated river corridor. Access is not prevented or denied in the Preferred Alternative, however additional analysis and permitting steps would be required.
- The use of helicopters would be affected by application of the Recommended Wilderness Management Area prescription. This will require the use of the "minimum tool concept" and may prevent certain types of inventory work from being done with helicopters and would be required to be done on foot. This could affect some future wildlife inventory work by the State of Alaska Department of Fish and Game.
- The State of Alaska, Department of Transportation and Public Facilities plan to improve the Sterling Highway (State Highway 5). Their project includes a controversial relocation alternative along Juneau Creek.

RESOURCE COMMITMENTS

Energy Requirements for Implementing the Alternatives

- Energy consumed in timber harvesting is the amount required for felling, bucking, skidding, loading, hauling, for performing road maintenance, and for the industrial traffic associated with harvest activities.

- Energy consumption related to recreation is based on the estimated number of dispersed and developed recreation visitor days, estimated trip lengths, and facility construction.
- Energy consumed in road construction and reconstruction activities is that used by contractors in completing road development.
- Energy consumed by Forest Service administrative activities includes vehicle use, lighting, heating of buildings, and fuel used in such equipment as small engines and propane burners.

Unavoidable Adverse Effects

The application of Forestwide standards and guidelines and resource protection measures would limit the extent and duration of any adverse environmental effects. Nevertheless, some adverse effects are unavoidable. For detailed disclosure of all effects, including unavoidable adverse effects, see the preceding Environmental Consequences discussions for each resource area (air, biological diversity, recreation, minerals, etc.).

Hazardous Materials

The use of motor vehicles and the transport of hazardous material such as gasoline, other fuels, and building materials on roads and highways carry the potential for accidental spills.

Relationship Between Short-term Uses of the Environment and Long-term Productivity

Short-term uses are those expected to occur on the Forest over the next ten years. These uses include, but are not limited to, recreation use, mineral development, timber harvest, and prescribed burning. Long-term productivity refers to the capability of the land to provide resource outputs for a period of time beyond the next ten years.

The minimum management requirement established by regulation (36 CFR 219.27) provides for the maintenance of long-term productivity of the land. Minimum management requirements prescribed by the Forestwide standards and guidelines will be met under all alternatives. Minimum requirements assure that long-term productivity of the land will not be impaired by short-term uses.

Although all alternatives were designed to maintain long-term productivity, there are differences among alternatives in the long-term availability or condition of resources. There may also be differences among alternatives in long-term expenditures necessary to maintain desired conditions. These types of differences among the alternatives are described in the FEIS, Chapters 2 and 3.

Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitment of resources is defined as follows in Forest Service Handbook 1909.15 (2/21/95):

> The irreversible commitment of resources means that nonrenewable resources are consumed or destroyed. Examples include mineral extraction, which consumes nonrenewable minerals and potential destruction of such things as heritage resources by other management activities. These consumptions or destructions are only renewable over extremely long periods of time.
>
> The irretrievable commitments of resources represent trade-offs (opportunities foregone) in the use and management of forest resources. Irretrievable commitment of resources can include the expenditure of funds, loss of production, or restrictions on resource use.

Decisions made in a forest plan do not represent actual irreversible or irretrievable commitment of resources. A forest plan determines what kind and levels of activities are appropriate on the Forest; it does not make site-specific or project decisions. The decision to irreversibly or irretrievably commit resources occurs:

1. When the Forest Service makes a project or site-specific decision.
2. At the time Congress acts on a recommendation to establish a new Wilderness or to include a river in the Wild and Scenic River System.

The Oil and Gas Leasing Analysis determined that certain lands of the Forest would be made available for oil and gas leasing. Essentially, this analysis allows the Bureau of Land Management to conditionally authorize certain National Forest System lands for oil and gas exploration and production (36 CFR 228.102(e)). Although surface disturbance cannot occur on leased land without further analysis and decision-making, issuance of a lease confers certain rights on the lessee and therefore represents a commitment of resources.

Lands in Zones 1, 2, 3, and 4 were analyzed in the Revised Forest Plan. Little potential for development exists on Zone 4 lands. The effects of the exploratory and developmental wells were analyzed and disclosed for all alternatives.

Examples of irretrievable resource commitments associated with Revised Forest Plan decisions are as follows:

> Commodity outputs and uses (such as motorized recreation) would be curtailed or eliminated in areas recommended for and subsequently designated as Wilderness, Wild and Scenic Rivers, and Research Natural Areas.
>
> Opportunities for nonmotorized recreation, solitude, and primitive or wilderness experiences would be foregone if portions of the Forest

are not allocated or recommended for and subsequently designated for these purposes.

Timber volume outputs would be foregone on lands determined as not suitable for harvest.

Commodity outputs would be reduced or foregone on areas allocated to specific uses or purposes, such as developed recreation sites, old growth habitat, or botanical areas.

Noncommodity values, including scenic resources, may be reduced or foregone in areas allocated to commodity uses.

To the degree that an alternative preserves or encourages the development of mature and old-growth habitat, opportunities to develop early successional habitat are reduced.

Chapter 4–List of Preparers

Chapter 4 – List of Preparers

A listing of the major preparers (Interdisciplinary Team) of the Chugach National Forest Final Environmental Impact Statement and Revised Forest Plan follows. Throughout the preparation of these documents, many individuals assisted in a variety of ways. Without their expertise, ideas and opinions, the writing of these documents would not have been possible. The Forest Leadership Team members are listed and were involved in the review of these documents throughout the planning process. Other contributors are also listed.

The Interdisciplinary Team

Gary Lehnhausen – Forest Planner/Interdisciplinary Team Leader

Education: Graduate study in Wildlife Management, Fresno State University, 1980-1991; B.S. in Wildlife Management, Utah State University, 1972.

Experience: 27 years with the Forest Service in California and Alaska. Assignments as a zone wildlife biologist, wildlife biologist, planner, and forest planner.

William J. Connelly – Forest Planning/NFMA Specialist

Education: M.S. in Economics, University of Oregon; B.A. in Social Studies, Denison University.

Experience: 21 years experience with the Forest Service on 1 Forest and in 1 Regional Office. 11 years as Economist/Program Analyst on the Umpqua National Forest. 10 years as Operations Research Analyst/Program Analyst Strategic Planning Staff, Pacific Northwest Regional Office.

Lisa Crone – Economist / Social Scientist

Education: Ph.D. in Economics, University of Wyoming, 1993; B.A. in Economics, University of Montana, 1984.

Experience: 4 years with the Forest Service on 1 Forest and 1 Research Station. Economist, Pacific Northwest Research Station, Corvallis, OR and Walla Walla, WA (Interior Columbia Basin Ecosystem Management Project). Assistant Professor of Economics, Weber State University.

John DeLapp - Ecologist

Education:	M.S. in Botany/Ecology, North Carolina State University, 1978; B.S. in Wildlife Biology, North Carolina State University, 1974.
Experience:	5 years with the Forest Service on 2 National Forests. Over 20 years with federal, state, and private environmental agencies and organizations.

Warren Eastland – Wildlife Biologist

Education:	Ph.D. in Wildlife Management, University of Alaska Fairbanks, 1991; M.S. in Wildlife Science, Texas A&M University, 1983; B.S. in Wildlife Resources, 1981.
Experience:	Over 20 years with federal, state, private, and international agencies, organizations, and universities. Assignments in wildlife research, teaching, and management, and ecologically sustainable land use planning.

Steve Hennig – Landscape Architect

Education:	M.S. in Landscape Architecture, Utah State University, 1977; B.S. in Forestry, Michigan Technological University, 1973.
Experience:	22 years with the Forest Service on 1 National Forest. Assignments in landscape architecture, recreation planning, interpretive services, recreation management, special use permits, facilities management, and forest planning.

Warren Oja - Forester

Education:	B.S. in Forest Resource Management, University of Minnesota, 1977.
Experience:	22 years with the Forest Service on 2 National Forests, 1 Research Station and 1 Regional Office. Assignments in recreation, timber sales planning, preparation, and administration, forest planning, forest inventory, NEPA EIS projects (team leader), and forest restoration.

Karin Preston – Natural Resources Database Coordinator

Education:	B.S. in Geography, Charter Oak State College, 1997.
Experience:	19 years with Forest Service on 1 Forest. Assignments in real estate management and geographic information systems.

Sharon Randall – Writer-Editor/Documents Coordinator

Education: M.A. in Recreation Resource Management, University of Maryland, 1984; B.S. in Outdoor Recreation, University of Maryland, 1979; B.S. in Botany, University of Maryland, 1978.

Experience: 10 years with the Forest Service on 1 National Forest and 1 Research Station. 3 years with the National Park Service. Assignments in social science survey research and recreation planning.

Patrick Reed – Interdisciplinary Science Advisor

Education: Ph.D. in Wildland Recreation, Colorado State University, 1985; M.A. in Recreation Administration, Chico State University, 1978; B.S. in Natural Resources, Humboldt State University, 1973.

Experience: 10 years with the Forest Service on 2 National Forests and 1 Research Station. Assignments in forest planning, social science research, and recreation planning.

Julie Schaefers – Economist

Education: M.S. in Resource Economics, Colorado State University, 1994; B.S. in Forest Recreation, Oregon State University, 1989.

Experience: 10 years with the Forest Service on 6 National Forests. Assignments in Forest Planning, timber sales, recreation special use permits, environmental justice, and NEPA EIS projects (team leader).

Theron E. Schenck II – Wildlife Biologist

Education: Command and General Staff, Ft. Leavenworth, KS, 1990; Engineer Officer Advanced, Ft. Belvoir, VA, 1976; Infantry Officer Basic, Ft. Benning, GA, 1972; M.S. in Wildlife Biology, South Dakota State University, 1971; B.S. in Wildlife Management, South Dakota State University, 1968.

Experience: 13 years with the Forest Service on 4 National Forests. Assignments in wildlife management, subsistence, NEPA EIS projects, and forest planning. 15 years with South Dakota Game, Fish & Parks. Assignments as conservation officer, land management, game management.

Richard H. Smith – EIS/NEPA Specialist

Education:	B.S. in Wildlife Technology, University of Montana, 1963.
Experience:	35 years experience with the Forest Service on 5 National Forests. Assignments in timber, fire, recreation, wildlife, range, planning, and environmental law. Staff Officer Planning, Fire, and Timber 1981 – 1999. Retired 1999.

Steve Zemke – Fisheries Biologist

Education:	B.S. in Fisheries Management, University of Idaho, 1973.
Experience:	22 years with the Forest Service on 8 National Forests and Alaska Regional Office. Assignments have been in timber management, wildlife and fish management, fish habitat relationships, and forest planning.

Alan Vandiver – Forester

Education:	B.S. in Forest Management, Washington State University, 1978.
Experience:	22 years with the Forest Service on 5 National Forests. Assignments in timber, fire, and watershed management.

Extended Interdisciplinary Team

Dave Blanchet - Hydrologist

Education:	Graduate work in Watershed Science (1 ½ years), Colorado State University; B.S. in Geology, Williams College, 1972.
Experience:	25 years with the Forest Service on 5 National Forests. Assignments in fish, wildlife, recreation, and timber projects, restoration, NEPA coordination, Forest planning, and watershed analysis. 1 year with the USGS Water Resources Division. Assignments collecting surface water data.

Dean F. Davidson – Soil Scientist

Education:	M.S. in Soils and Hydrology, Utah State University, 1975; M.S. in Geology, Utah State University, 1969; B.A. in Chemistry, Carthage College, 1966.
Experience:	26 years experience on 6 National Forests. Assignments in soils, and landform inventories, interpretations for timber sales, watershed assessments, restoration, and forest planning. 2 years as a geologist for Texaco, Inc.

Rob DeVelice – Forest Ecologist

Education:	Ph.D. in Biology, New Mexico State University, 1983; Master of Science in Agronomy, New Mexico State University, 1979; Bachelor of Science in Forestry, University of Montana, 1976.
Experience:	7 years with the Forest Service on 1 National Forest. Assignments in community ecology statistical analysis, vegetation dynamics modeling, and conservation biology. 3 years with The Nature Conservancy with assignments as an ecologist with the Natural Heritage Program in Montana. 2 years with the Environmental Protection Agency with assignments as an ecologist with the global climate change program in Oregon. 3 years with the Biological Resources Center as an ecologist in New Zealand.

Carol Huber – Forest Geologist

Education:	B.S. in Geology, University of Alaska, Fairbanks, 1989.
Experience:	13 years with the Forest Service on 1 National Forest. Assignments in abandoned/inactive mine hazards, mineral materials appraisal, mineral resource assessment, mining operation compliance, interagency strategic planning and forest planning.

Linda Kelly – GIS Analyst

Education:	B.S. in Forest Management, Washington State University, 1976.
Experience:	24 years with Forest Service on 3 National Forests. Assignments in geographic information systems in support of forest planning, budget analysis, minerals management, level 4 law enforcement, and timber management.

Jan Lerum – Regional Planner

Education:	B.S. in Forestry, University of Montana, 1981.
Experience:	20 years experience on 4 National Forests, 1 Research Station, and 1 Regional Office, in forest planning, environmental analysis, coordination and documentation, public affairs, and public involvement.

Larry Rickards – Wildlife Biologist

Education:	B.S. in Wildlife Management, Colorado State University, 1973.
Experience:	Over 20 years experience with the Forest Service. Assignments in timber management in Region 6 and wildlife management in Regions 6, 4 and 10.

Guy Robertson – Regional Economist

Education:	Ph.D. in Forest Economics, University of Washington, 1999; M.A. in International Studies, University of Washington, 1991; B.A. in Philosophy, Carleton College, 1983.
Experience:	5 ½ years experience with the Forest Service. 5 years as a research economist with PNW Research Station. Work assignments and doctoral research in economic dynamics of forest communities. Currently working as Regional Economist, Forest Service, Alaska Region (since January, 2000).

Susan Rutherford

Education:	M.S. in Forest Hydrology, University of Minnesota, 1981; B.S. in Biochemistry, University of California, 1975.
Experience:	Over 20 years with the Forest Service in two regions, three national forests, and national office. Assignments as Staff Officer, District Ranger, National Trails Leader, Forest Hydrologist.

Paula Smith – GIS Analyst

Education:	Graduate work in Forestry, University of Montana, Washington State University, University of Idaho, 1976-81; B.S. in Forestry, University of Montana, 1976.
Experience:	22 years with the Forest Service with 1 Forestry Sciences Lab and 5 National Forests. Assignments in forest inventory, silviculture (including NEPA EA projects), timber, recreation (including special use permits), interpretive services, law enforcement, and geographic information systems.

Mike Stubbs – Fire and Aviation Officer

Education:	Post Graduate work in Public Administration, Utah State University, 1980's; M.S. in Forest Management, Colorado State University, 1979; B.S. in Forest Management, Colorado State University, 1978.
Experience:	21 years with the Forest Service on 3 National Forests. Assignments in fire, timber, recreation, special uses, law enforcement, minerals, fleet, facilities, roads, trails, volunteer programs, planning, EEO counseling, Fire Incident Management National Type I Teams (Planning - Resources), and aviation.

Linda Fin Yarborough – Acting Forest Archaeologist

Education:	M.S. in Anthropology, University of Wisconsin – Madison, 1996; M.A. in Anthropology, University of Toronto, 1974; B.A. in Anthropology, SUNY at Binghamton, 1973.
Experience:	10 years with the Forest Service on 1 National Forest. Cooperative Education student with assignments including assisting the Forest Archaeologist, working on NAGPRA repatriations and assessments, directing Exxon Valdez oil spill archaeological site restoration projects, working as Acting Forest Archaeologist. 14 years as Principal Investigator for Cultural Resource Consultants. Archaeological/anthropological consultant assignments included preconstruction archaeological surveys around Alaska, National Register Nominations, cultural education programs, and prehistoric and historic research. 15 years as Adjunct Instructor, University of Alaska, Kodiak and Anchorage, anthropology and archaeology courses.

Forest Plan Revision Support

Christopher Aldridge	Administrative Record Assistant
Colette Buchholtz	Biologist
Trish Clabaugh	Social Science Planning
Yvette Frazier	Information Systems Coordinator
Lauro Garcia	Computer Support Specialist
Annette Heckart	Information Systems Coordinator
Victoria Hough	Information Systems Coordinator
Betty Kothe	Administrative Record Assistant
Cliff Larson	Administrative Record Assistant
Marti M. Marshall	Recreation Planning
Susan Nelson	Administrative Record Assistant
Erica Osterman	Information Systems Coordinator
Stacy Prosser	Biologist
Mona Spargo	Public Affairs Specialist
Dave Strehle	Computer Support Specialist
Nicole Vasquez	Administrative Record Assistant
Tyrone Woody	Administrative Record Assistant

The Chugach National Forest Leadership Team

Dave Gibbons	Forest Supervisor
Cal Baker	District Ranger, Cordova Ranger District
Jim Fincher	District Ranger, Glacier Ranger District (1/2002)
Chuck Frey	Planning Staff Officer
Dave Hackett	Administrative Officer, Acting
Mike Kania	District Ranger, Seward Ranger District
Kent Kohlhase	Engineering Staff Officer, Acting
Becky Nourse	District Ranger, Cordova Ranger District (1/2002)
Mike Novy	Resources Staff Officer
Jamie Quade	Administrative Staff Officer
Don Rivers	Engineering Staff Officer
Susan Rutherford	Public Service Staff Officer
Deidre St. Louis	District Ranger, Glacier Ranger District
Doug Stockdale	Public Affairs Staff Officer
Gerry Xavier	Engineering Staff Officer (7/2001)

Chapter 5–List of Recipients

Chapter 5 - List of Recipients

Copies of the Final Environmental Impact Statement, Revised Land and Resource Management Plan and/or the Executive Summary were sent to the following elected officials, tribal governments, federal, state, and local agencies, organizations, businesses and individuals. Copies of these documents are available for review at all Chugach National Forest offices, or on our web site:

http://agdc.usgs.gov/cnf

Elected Federal Officials

US Senator Frank Murkowski

US Senator Ted Stevens

US Representative Don Young

Elected State Officials

Governor Tony Knowles

Tribal Governments

Chenega IRA Council
Eyak Native Village
Eyak Tribal Council
Kenaitze Indian Tribe IRA
Knik Tribal Council
Native Village of Eyak
Native Village of Nanwalek
Native Village of Port Graham
Native Village of Tatitlek
Ninilchik Native Association, Inc.
Ninilchik Traditional Council
Port Graham Village Council
Qutekcak Native Tribe
Salamatof Native Association
Seldovia Village Tribe
Tatitlek IRA

Federal Agencies

US Department of Agriculture, Forest Service, Washington Office
Alaska Regional Office (R10)
Advisory Council on Historic Preservation
Arapaho and Roosevelt National Forests
Bighorn National Forest
Black Hills National Forest
Eastern Regional Office (R9)
Federal Aviation Administration
Federal Energy Regulatory Commission
Federal Highway Administration
Grand Mesa, Uncompahgre, and Gunnison National Forests
Intermountain Regional Office (R4)
Interstate Commerce Commission
Lassen National Forest
Medicine Bow and Routt National Forests
Minerals Management Service
National Marine Fisheries Service
NOAA Office of Policy and Strategic Planning
Nebraska National Forest
North Central Forest Experiment Station
Northern Regional Office (R1)
Pacific Northwest Regional Office (R6)
Pacific Southwest Regional Office (R5)
Pike and San Isabel National Forests
Rio Grande National Forest
Rocky Mountain Regional Office (R2)
San Juan National Forest
Shoshone National Forest
Southern Regional Office (R8)
Southwestern Regional Office (R3)
USDA, Natural Resource Conservation Service
US Department of Interior
US Environmental Protection Agency, Juneau Office
USDI Bureau of Land Management, Alaska State Office
USDI Fish and Wildlife Service
USDI Fish and Wildlife Service, Anchorage Office
USDI National Park Service
US Environmental Protection Agency
USGS/Biological Resource Division
Wrangell-St. Elias National Park and Preserve

State Agencies

Alaska Department of Environmental Conservation
Alaska Department of Fish and Game
Alaska Department of Natural Resources
Alaska Department of Transportation and Public Facilities
Alaska Division of Parks and Outdoor Recreation
Alaska Division of Tourism
Alaska Office of Governmental Coordination
Alaska Public Lands Information Center
Alaska State Legislature
Alaska State Office, Housing and Urban Development
Alaska State Historic Preservation Officer

Local Agencies

City and Borough of Anchorage
City of Cordova
City of Seward
City of Soldotna
City of Valdez
City of Whittier

Media

Alaska Public Radio Network
Anchorage Daily News
Anchorage Press
Cordova Times
Juneau Empire
Peninsula Clarion
Seward Phoenix Log
Turnagain Times

Native Corporations

Chugach Alaska Corporation
Cook Inlet Region, Incorporated
Chenega Corporation
Chickaloon Moose Creek Native Association
Eklutna, Incorporated
English Bay Corporation
Eyak Corporation
Knikatnu, Incorporated
Ninilchik Native Association
Port Graham Corporation
Salamatof Native Association
Seldovia Native Association
Tatitlek Corporation
Tyonek Native Corporation
Yak-Tat-Kwaan, Incorporated

Organizations and Businesses

Alaska Action Center
Alaska Center for the Environment
Alaska Cooperative Extension
Alaska Earth Sciences
Alaska Forest Association, Inc.
Alaska Miners Association
Alaska Outdoor Council
Alaska Pacific University
Alaska Quiet Rights Coalition
Alaska Rainforest Campaign
Alaska Sealife Center
Alaska Sightseeing/Cruise West
Alaska State Library
Alaska State Snowmobile Association
Alaska Wildland Adventures
Alaska Visitors Association
Alaskan Wilderness Sailing Safaris
Alpine Air, Inc.
Alyeska Resort
American Canoe Association
American Rivers Association
American Wildlands
Anchorage Audubon Society
Anchorage Snowmobile Club
Center for Marine Conservation
CH2MHILL
Christopher Beck & Associates
Colorado State University Libraries
Cooper Landing Advisory Committee
Copper River/PWS Advisory Committee
Copper River Watershed Project
D & L Construction
Earth Justice Legal Defense Fund
Emcon Alaska, Inc.
Environmental Systems Research, Inc.
Forest Conservation Council
Greystone Environmental Consultants, Inc.
Harza Northwest, Inc.
HDR Alaska, Inc.
Herman Forestry Consulting
Homer Parks, & Recreation
Hope Sunrise Advisory Planning Committee
Kenai River Property Owners Association
Kenai Watershed Forum
Koncor Forest Products Co.
Koniag, Inc.
Mine Evaluation and Management
National Audubon Society
National Outdoor Leadership School
National Wildlife Federation
Primrose Mining Co.
PWS Setnet Association
Resource Development Council
SEACC
Sierra Club, Alaska Rainforest Office
Sierra Club, Alaska Task Force
Taiga Resource Consultants
Tak Outfitters
Ted Stevens Anchorage International Airport
Texas Forest Service
The Coastal Coalition
The Great Alaska Fish Camp
The Nature Conservancy
The Wilderness Society
University of Alaska, Anchorage, Department of Anthropology
University of Alaska, McGrath
Vanderlinden and Company
Wildlife Management Institute

Individuals

The names of individuals are too numerous to list, however, a complete listing is available in the planning record.

Chapter 6–Public Participation and Comment on the DEIS and Proposed Revised Forest Plan

Chapter 6 - Public Participation and Comment on the DEIS and Proposed Revised Forest Plan

The Forest Service has documented, analyzed, and responded to the public comments received on the Draft Environmental Impact Statement (DEIS) and the Proposed Revised Chugach National Forest Land and Resource Management Plan (Proposed Revised Forest Plan). Appendix K describes the substantive comments received on the DEIS and the Proposed Revised Forest Plan. It also contains the Forest Service responses to those comments. In addition, Appendix K contains copies of all letters received from federal, state, city, borough and tribal governments, as well as elected officials. This response complies with section 40 CFR 1503.4 of the National Environmental Policy Act regulations, Response to Comments.

Public Participation on the DEIS and Proposed Revised Forest Plan

Public Comment Period

The DEIS and the Proposed Revised Forest Plan were released for public review and comment on September 15, 2000. A CD-ROM copy of the documents was also made available. Over 400 copies of the documents, 600 copies of the CD-ROM, and 200 document summaries were disturbed to interested parties. The 90-day comment period ended December 14, 2000. Over 33,000 cards, letters, and e-mail responses on the DEIS and Proposed Revised Forest Plan were received. Of these, over 27,000 were form letters. There were 38 different kinds of form letters. Three responses came from federal agencies, three from state governments, three from borough governments, three from city governments, and two from tribal governments having sovereign status. All comments were included in a computerized DEIS/Proposed Revised Forest Plan database.

The Chugach National Forest hosted a series of Open House meetings during the public comment period to discuss the DEIS and Proposed Revised Forest Plan. Open House meetings were conducted in Whittier, Moose Pass, Girdwood, Cordova, Anchorage, Valdez, Cooper Landing, Hope, and Soldotna. The purpose of the meetings was to help the public learn more about the documents, maps and other tools such as the compact disc and interactive web that was available to the public to help them formulate and submit comments.

Comments on the DEIS and the Proposed Revised Forest Plan were received from nearly every state. The majority of the comments were from outside Alaska (90 percent). Most of these comments dealt with Wilderness designation, particularly on the Copper River Delta. Local residents expressed most of the interest in motorized and nonmotorized recreational use on the Kenai Peninsula. They suggested as many as 20 different viable management options for some areas.

Follow-up Meetings

As a follow-up, the Interdisciplinary Team (ID Team) held a meeting in each of the communities on the Kenai Peninsula. Meetings were conducted in Anchorage, Girdwood, Seward, Soldotna, and Hope in March 2001. The purpose of these meetings was to focus discussion on the pros and cons of a variety of motorized/nonmotorized recreation management options for areas around their community suggested during the comment period. The ID Team conducted a public meeting in Anchorage in March 2001 to present a brief summary of public comments received during the comment period and a general discussion of the potential changes in the DEIS and Proposed Revised Forest Plan. Meetings were held with government agencies to clarify their comments. Additional meeting were conducted in May 2001 to get ideas from members of the public and other agencies on potential monitoring items, and standards and guidelines to be included in the Revised Forest Plan. In August 2001 the Forest Supervisor met with government agencies and Native tribes to discuss changes in the Preferred Alternative.

Content Analysis

A systematic method of compiling, categorizing, and capturing the full range of public viewpoints and concerns about the DEIS and Proposed Revised Forest Plan, called *content analysis*, was used to review public comments. Content analysis helps the ID Team organize, clarify, analyze, and be responsive to information provided by the public. The content analysis process is not a vote-counting process. The process is designed to read each response, capture the meaning of each individual comment within that response, and provide the ID Team and decision maker information about the issues in an understandable form.

Upon receipt of each response, the Forest Service assigned it an identifying number and entered it into an electronic database. The database identified such items as: type of response, location of respondent, type of document being reviewed, geographic area of concern - primary issue, resource interest area, prescription - key areas, and the text of each substantive comment. The database allowed the Forest Service to query the comments in a number of ways. About 37,250 substantive comments were identified. Substantive comments were reviewed and consolidated by the ID Team into 204 comments to be addressed in the FEIS. Substantive comments are those comments that address the adequacy of the DEIS or Proposed Revised Forest Plan, the merits of the alternatives or the analysis. Comments that simply state an opinion or were outside the scope of this analysis are considered nonsubstantive and are not responded to in the FEIS. Errors noted in the comments were corrected.

Comment Response

The ID Team reviewed the comments and evaluated whether they triggered a change in the alternatives, including the preferred alternative, required improving or modifying the environmental analysis, or supplementing or changing the Proposed Revised Forest Plan. The ID Team then drafted responses to each comment. Some information in the DEIS was corrected or clarified based on public comment containing many useful recommendations for improving the

DEIS and Proposed Revised Forest Plan. In addition, information and recommendations provided by the ID Team were considered and incorporated into the final documents. Although only substantive comments are responded to in the FEIS, all comments are important to the decision maker because they provide information on the opinions and preferences of those who took time to comment. The following is a summary of the public comments on the DEIS and Proposed Revised Forest Plan by subject area.

Summary of Public Comment on the DEIS and Proposed Revised Forest Pan

DEIS

The Alternatives. Most respondents did not list an alternative preference. Many of those that did supported Alternative F. Most of these respondents suggested modifying Alternative F to include all of the Nellie Juan-College Fiord Wilderness Study Area and the Copper River Delta as Wilderness, replacing the backcountry designation (except immediately adjacent to developed areas) with the Recommended Wilderness Management Area prescription, and adopting the citizens' alternative for Wild and Scenic Rivers. Other respondents supported the No Action Alternative or current plan to maintain motorized winter recreational and other multiple use opportunities. Some respondents supported the Preferred Alternative. Many of these respondents suggested changing the Alternative to include more Wilderness, more snowmachine and helicopter closures, and fewer helicopter landings. Other respondents felt that the Preferred Alternative failed to meet the mandate for multiple use. Some respondents supported Alternative A, and/or the No Action Alternative. Most of these respondents were concerned about additional snowmobile closures. A few respondents supported Alternatives B, D and E.

Planning Process. There were a few comments on the planning process. Some respondents were concerned with tribal rights, coordination with the management of adjacent lands, the cumulative effects analysis, the use of key indicators, the use of the new planning rule, and the legality of the EIS and Revised Forest Plan.

Environmental Effects. Many respondents commented on the environmental analysis. Some respondents felt that the situation created by the spruce bark beetle epidemic was not adequately addressed. The Kenai Peninsula Borough recommended adoption of more comprehensive provisions for dealing with the epidemic.

There were many suggestions for improving the wildlife effects analysis. Several respondents felt that the cumulative effects analysis was not adequate. Many people wanted additional wildlife species included in the analysis and that more attention should be given to the brown bears on the Kenai Peninsula. Some respondents were concerned with the effects of aircraft overflights on wildlife.

Some respondents questioned the ownership of "coastal lands" (tide and submerged lands). Some respondents felt that the DEIS did not address significant impacts to adjacent lands.

Several respondents were opposed to any additional restrictions on winter motorized use. They wanted no net loss of areas for snowmobiling. Some respondents disagreed with specific closures to winter motorized use (Crescent and Carter Lakes, Divide Creek area of Bench Peak, Ingram Creek (timeshare), Johnson Lake, Lost Lake (timeshare), Russian Lake, Seattle Creek, Skookum Valley, Snow River, and Twentymile Valley). Twentymile is popular with local snowmobilers, since the Girdwood Valley has been closed to snowmobiling. The backside of Turnagain Pass (Seattle Creek) is possibly the most popular and heavily used area in the state. Either open the Resurrection Pass Trail to snowmobiles on a full-season basis, or swap the springtime restriction of snowmobiles on a seasonal basis. Some respondents did not agree with any plan that restricts access to an open area on a “date type” criteria. One respondent suggested closing Portage Valley to snowmobiles instead of the Twentymile Valley, Skookum Valley, Seattle Creek, and Snow River areas. Another thought was that Kern Creek, Peterson Creek and Bear Valley provided adequate nonmotorized areas. One respondent wanted the snowmobile areas at Turnagain Pass and Placer/Skookum closed to non-snowmobilers. The proposed closures of the Skookum and Twentymile Valleys would close 2/3 of the limited, beginner level terrain.

Several respondents wanted to see the Proposed Revised Forest Plan more effectively address nonmotorized recreation needs. Some respondents suggested additional closures (Johnson Pass Trail - north end, Snow River, 4 miles north of the Canyon Creek footbridge, the slope behind Summit Lake Lodge, Fresno Ridge, Crescent and Carter Lakes, Russian River Trail, Jack Bay, Sawmill Bay, Marshall Pass, Manitoba Mountain and Tiehack Mountain). Some respondents supported setting aside a minimum of 10 percent of the Kenai Peninsula for nonmotorized recreation. Areas identified as best meeting this need included the Resurrection Pass Trail corridor and the Lost Lake area – with a 50/50 time share (one respondent wanted the cutoff date moved from April 1 to March 1), Snow River and South Fork Snow River, expanding the Manitoba area, a time share on Carter/Crescent Lakes and the North end of Johnson Pass. Another respondent thought the addition of Seattle Creek, Kern Creek, Peterson Creek, and Bear Valley along with previously identified terrain in Turnagain Pass would be adequate to provide for the needs of nonmotorized recreationists. Still other respondents wanted Jack and Sawmill Bays closed to all motorized use and South Fork Snow River, Johnson Pass Trail, Carter and Crescent Lakes, and Fresno Ridge closed to snowmobiles. Some respondents favored closing most of the Kenai Peninsula to snowmobiling, while another wanted snowmobiles limited to designated routes and trails. One respondent wanted the Martin River drainage closed to motorized use in the summer.

One respondent suggested, for the Twentymile Valley, that we 1) substitute a split season motorized closure for an alternative year closure or 2) designate a motorized corridor on the west side of the valley. They also suggested for Johnson Pass, that the motorized use closure boundary should be moved from Center/Divide Creek to Bench Creek until reaching the bridge where Bench Creek makes a 90-degree turn. And for Seattle Creek, the nonmotorized

designation is useless unless snowmachines are prohibited from reaching the ridge. It is too dangerous for snowmachines and skiers to share the one safe route into the area. Another respondent objected to these proposed changes because of the loss of solitude.

The State of Alaska believed that more work is necessary and that additional options be explored to craft acceptable solutions at Lost Lake and the Twentymile areas. Displacement of concentrated motorized use at Lost Lake could shift to the Resurrection Pass Trail area, which supports the Kenai Mountain caribou herd, a moderate density of moose, and a limited number of sheep and goats.

Several respondents commented on the level of helicopter landings. Some respondents wanted "no change" in the areas currently open to helicopter landings. Others supported a reduction in the areas open. Some were concerned with the level of helicopter activity around Seward. While still other respondents did not want any restrictions on helicopter landings in Wilderness. The State of Alaska was concerned about the potential impacts of increased heli-skiing and heli-hiking in important goat and brown bear areas.

Several respondents wanted the Forest Service to prohibit or limit jet ski use. Other respondents wanted the use of airboats restricted. One recommended an exception for seasonal use on the Copper River Delta. Another respondent suggested that because of the low number of users, under Wilderness, this use be phased out. One respondent wanted some lakes (like Bench and Johnson Lakes) closed to floatplanes.

One respondent mentioned that there had been no documented evidence of damage to flora and fauna by the motorized user group. Others questioned if there had been any specific studies done and, if so, what were the results. The USDI recommended that the FEIS discuss potential impacts to air and water quality, wildlife and human health. Since most of the snowmobiling takes place on the Kenai Peninsula the direct and cumulative impacts should be addressed.

Some respondents supported preserving all roadless areas. Some respondents questioned how the new Roadless Rule would be implemented.

Several respondents were concerned with access rights and traditional activities.

Many respondents supported additional Wild and Scenic Rivers (Alternative F). Rivers recommended included the entire Twentymile System, Snow River, the entire Nellie Juan River, Gravina River, Rude River, Upper Russian River, and all rivers in the Copper River Delta (Alaganik Slough, Bering River, Copper River/Copper River Delta, Katalla River, Martin River, Martin Lake, and Bering Lake. Other respondents were opposed to recommending any Wild and Scenic Rivers for designation.

There were numerous comments on Wilderness recommendations. Nearly 28,000 respondents supported additional Wilderness. Most of these respondents requested Wilderness protection for the Copper River Delta, Prince William Sound (Nellie Juan-College Fiord Wilderness Study Area, Knight and Montague

Islands, and Jack and Sawmill Bays), and the Kenai Peninsula (brown bear habitat, Snow River, and the Kenai River watershed). Respondents noted that the Copper River Delta was the largest intact wetland on the Pacific Coast of North America, habitat for healthy salmon and commercial fishing, 16 million shorebirds and waterfowl, moose, brown bears, wolves, beavers, and more. Several respondents were opposed to any logging or mining on the Delta. Several respondents supported a working draft of the Preferred Alternative that recommended Wilderness designation for the eastern portion of the Copper River Delta. Respondents noted that Wilderness designation would help species in the Prince William Sound that had not recovered from the 1989 *Exxon Valdez* oil spill and would protect wildlands from being overrun by unregulated large-scale industrial tourism. Other areas recommended for Wilderness include Twentymile, Snow River, Resurrection Creek, Russian River, Seattle Creek, Hinchinbrook Island, Hawkins Island, and Montague Island.

Some respondents were opposed to any Wilderness classification. They did not want any recommended Wilderness or supported only the absolute minimum Wilderness designation. A few respondents were specific to the east side of the Copper River Delta. Most of these respondents supported the 501(b) - 2 Management Area prescription for the area. Other respondents were fearful that with Wilderness, over time, traditional and current permitted uses would be curtailed.

Some respondents questioned the timber and minerals data and analysis. Others thought the economic analysis was not complete.

Proposed Revised Forest Plan

Forestwide Direction. There were many suggestions to improve and strengthen Forestwide standards and guidelines. Many of these comments centered around wildlife concerns.

Management Area Prescriptions. There were many suggestions to change management area prescriptions. Many of these suggestions centered on Wilderness designation, wildlife values and motorized/nonmotorized use. Several respondents felt that utility corridors should not be allowed in the Brown Bear Core Area Management Area prescription. A number of respondents suggested that road construction was not compatible with the management intent of the Fish and Wildlife Conservation Area Management Area prescription. Many people said that the wide variety of exceptions for motorized/nonmotorized use relative to the prescriptions were difficult to understand.

Monitoring and Evaluation. There were many suggestions to improve the monitoring plan. The Environmental Protection Agency stated that the monitoring plan be revised and refined. They had several suggestions to improve it. Another respondent suggested the Revised Forest Plan provide a more comprehensive and detailed discussion of how research and monitoring would be incorporated into the management of the Forest over the next 10 years.

Access Management Plan. There were many suggestions to change the Access Management Plan. Many of these suggestions centered around the motorized/nonmotorized issue on the Kenai Peninsula.

Our responses to these and other substantive comments on the DEIS and the Proposed Revised Forest Plan are found in Appendix K of the FEIS.

References

References

Adams, S.E. 1975. Effects of lead and hydrocarbons from snowmobiles exhaust on brook trout (*Salvalinus fontinalis*). Transaction of the American Fisheries Society: 104(2) 363-373.

ADF&G (Alaska Department of Fish and Game). 2001a. Region II Briefing Book. Alaska Dept. of Fish and Game, Division of Wildlife Resources. Juneau, Alaska.

ADF&G (Alaska Department of Fish and Game). 2001b. Alaska wildlife harvest summary. Alaska Department of Fish and Game web page (http://www.state.ak.us/adfg/wildlife/geninfo/hunting/harvest.htm) PDF document.

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Glossary

Glossary

A

Access The opportunity to approach, enter and make use of public lands.

Access management Acquiring rights and developing and maintaining facilities needed to approach, enter and make use of public lands.

Acquired land Lands in federal ownership, which were obtained by the Government through purchase, condemnation, gift, or by exchange.

Active channel As defined for purposes of the riparian standards and guidelines . . . includes stream channels*, secondary channels*, and braided channels*. For the Alluvial Fan Process Group, it also includes gravel outwash lobes, (Words marked by a * have further definitions within the glossary).

Active reforestation The use of environmental manipulations such as scarification, prescribed burning, and planting to achieve reforestation.

Activities Uses or facilities associated with interest statements (i.e., recreational gold panning, prescribed fire, new trails).

Activity fuel loading The amount of burnable debris left after logging.

ADF&G Alaska Department of Fish and Game.

ADNR Alaska Department of Natural Resources.

Adaptive management A continuous process of action-based planning, monitoring, research, evaluation, and adjustment with the objective of improving implementation and achieving desired management goals and objectives.

Administrative facilities Cabins, campgrounds, and shelters for recreation. Forest Service developed or permitted facilities used to support fieldwork. Examples: field camp, work centers, temporary field camps, sale administration camps, cabins, or work centers.

Administrative and permitted motorized access Motorized access for administrative purposes or other activities as determined by permit through Forest Supervisor or District Rangers.

Administrative site Lands used as headquarters or administrative facility by a federal agency.

AHRS See Alaska Heritage Resource Survey.

Airshed Geographical areas, which, because of topography, meteorology, and climatic conditions, share the same air mass. Air is managed by airshed.

Alaska Heritage Resource Survey (AHRS) The official list of cultural resources in the State of Alaska, maintained by the Office of History and Archaeology, Alaska Division of Parks and Outdoor Recreation.

Alaska Lands Act (ANILCA) A shortened title for the Alaska National Interest Lands Conservation Act, enacted in 1980.

Allowable Sale Quantity (ASQ) The maximum quantity of timber that may be sold in each decade from suitable lands covered by the Forest Plan.

Alluvial fan A cone-shaped deposit of organic and mineral material made by a stream where it runs out onto a level plain or meets a slower stream.

Alluvium Recent soil deposits resulting from modern rivers, including the sediment laid down in riverbeds, flood plains, lakes, and at the foot of mountain slopes and estuaries.

Alpine Parts of mountains above tree growth.

Alternative An option proposed for decisionmaking.

Ambient air That air, external to buildings, encompassing or surrounding a specific region.

Ambient air quality standard The prescribed level of pollutants in the outside air that cannot be exceeded legally during a specified time in a specified geographical area.

Amenity Resource use, object, feature, quality, or experience that gives pleasure or is pleasing to the mind or senses. Amenity value typically describes those resource properties for which monetary values (or market values) are not or cannot be established.

Anadromous fish Fish, which mature and spend much of their adult life in the ocean, returning to inland waters to spawn. Salmon and steelhead are examples.

Anadromous Fisheries Habitat Assessment (AFHA) An assessment conducted in 1994 within the Tongass National Forest (published in 1995) to study the effectiveness of current procedures for protecting anadromous fish habitat and to determine the need for any additional protection.

Analysis of the Management Situation (AMS) A determination of the ability of the Forest to supply goods and services in response to society's demand for those goods and services.

ANCSA The Alaska Native Claims Settlement Act of December 18, 1971, Public Law 92-203, 92nd Congress, 85 Stat. 688-716.

ANILCA The Alaska National Interest Lands Conservation Act of December 2, 1980. Public Law 96-487, 96th Congress, 94 Stat. 2371-2551.

ANILCA, Section 501(b) lands Specific management direction established in Section 501(b) of ANILCA for the Copper/Rude River addition and the Copper River-Bering River portion of the Chugach National Forest.

Appropriate suppression action The planned strategy for suppression action (in terms of kind, amount, and timing) on a wildland fire which most efficiently meets fire management direction under current and expected burning conditions.

Critical protection Areas where human life or habitation are present have priority over all others. Immediate and continuous efforts are made to minimize loss of life and damage to property.

Full protection Valuable resources, such as commercial timber stands and historic structures exist; however, no human life or habitation exists in these areas. Immediate and aggressive action is taken to limit the number of acres burned.

Modified action Uninhabited area with resources of lesser value. Land managers consider tradeoff of acres burned versus suppression expenses. Fires during critical burning months are attacked, but a lower level of protection is provided when the risks of large, damaging fires is less.

Limited action Areas where the cost of fighting the fire is greater than the fire damage. Suppression efforts are limited to keeping a fire within a designated area or protecting critical sites within the areas.

Appropriation of land The act of selecting, devoting, or setting apart land for a particular use or purpose, such as appropriating land for public buildings and military reservations or other public uses (Black, 1979).

Aquaculture Maintaining, enhancing, and rehabilitating fish stocks through improvements and facilities, including the rearing of anadromous juvenile fish, generally in fresh water, for release into salt water for maturing to become available as a common property resource.

Aquatic ecosystem A stream channel, lake or estuary bed, the water itself, and the biotic communities that occur therein.

ARC/INFO ARC/INFO is the name of the Geographic Information System (GIS) software used for the Revision database.

Area of potential effects The geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if any such properties exist.

Arterial road Roads usually developed and operated for long-term land and resource management purposes and constant service.

ASQ See Allowable Sale Quantity.

Atmospheric dispersion The lofting and distribution of particulate matter from wood smoke into the atmosphere over time.

Available timberlands Timberland not withdrawn from use in production of timber products as a result of administrative statue or regulation.

B

Background (BG) A term used in scenery management to describe the distant part of a viewed landscape. Background is from 3 miles to the horizon line of identified viewing points such as roads, trails, or use sites.

Bank The continuous margin along a river or stream where all upland vegetation ceases.

Bankfull width The width of the wetted channel when the water surface is at the same elevation as the active floodplain.

Base sale schedule A timber sale schedule formulated on the basis that the quantity of timber planned for sale and harvest for any future decade is equal to or greater than the planned sale and harvest for the preceding decade, and this planned sale and harvest for any decade is not greater than the long-term sustained yield capacity.

Beach fringe The area inland from salt-water shorelines, which is typically forested.

Beachlog salvage The salvage of logs that have been washed-up on beaches. Special provisions in ANILCA allow beachlog salvage in Wilderness and National Monuments if it can be conducted without roads or use of vehicles on uplands.

Benchmark An analysis of the supply potential of a particular resource, or set of resources, subject to specific management objectives or constraints. Benchmarks define the limits within which alternatives can be formulated.

Best Management Practices (BMPs) Land management methods, measures or practices selected by an agency to meet its non-point source control needs. BMPs include, but are not limited to structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility. BMPs are found in Forest Service Handbook 2509.22.

Biogeographic provinces Ecological subdivisions of Alaska that are identified by generally distinct ecological, physiogeographic, and biogeographic features. Plant and animal species composition, climate, and geology within each province are generally more similar within than among adjacent provinces. Historical events (such as glaciers and uplifting) are important to the nature of the province and to the barriers that distinguish each province.

Biodiversity (a) Variety of life and its ecological processes; (b) The variety of organisms considered at all levels, from genetic variants belonging to the same species through arrays of genera, families, and still higher taxonomic levels, includes the variety of ecosystems, which comprise both the communities of organisms within particular habitats and the physical conditions under which they live.

Biological diversity The variety of life forms and processes, including the complexity of species, communities, gene pools, and ecological functions, within the area covered by a land management plan.

Biological potential The maximum possible output of a given resource limited only by its inherent physical and biological characteristics.

Biomass The total quantity, at a given time, of living organisms of one or more species per unit area or all of the species in a community.

BLM Bureau of Land Management, U.S. Department of the Interior.

Blowdown See Windthrow.

BMPs See Best Management Practices.

Board foot A unit of timber measurement equaling the amount of wood contained in an unfinished board 1 inch thick, 12 inches long and 12 inches wide.

Bole trunk of the tree A tree stem once it has grown to substantial thickness - roughly to that capable of yielding poles, sawlogs, or veneer logs.

Braided streams or channels A stream flowing in several dividing and reuniting channels resembling the strands of a braid, the cause of division being the obstruction by sediment deposited by the stream.

C

Cabins (Forest Service recreation cabins and safety shelters) Cabins and shelters for recreation cabin system.

Campgrounds (Forest Service developed campground facilities) The ability to construct or maintain campgrounds for concentrations of overnight recreational use. May range from small to large, simple to complex.

Canopy gap Natural openings created in the overstory of old-growth conifer forests from the loss of a single or small group of trees from windthrow, insects, or disease. Gaps are also created in second growth conifer stands to increase light penetration to the understory by cutting all of the trees in a small area to maintain or increase the number of understory plant species.

Catastrophic event Events resulting from a great and sudden calamity or disaster. In the case of forest stands such events may include windstorms, wildland fire, floods, snow slides, and insect outbreaks. Whether a disturbance event is called catastrophic is dependent on the context within which the event occurs, the scale of the event, and the effects of the event.

Capability The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity.

Capital investment cost Costs generally associated with construction such as trails, roads, and physical structures.

Carrying capacity The estimated maximum number of animals that can be sustained over the long term within a specified area.

CFL See Commercial forest land.

CFR Code of Federal Regulations.

Channel A natural waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks, which serve to confine the water.

Channel migration Movement of a stream or river channel within a flood plain area (or an alluvial fan) usually over an extended period of time.

Channel sideslope The area from the stream channel to the side-slope break. See also Side-slope break.

Channel type A means of distinguishing parts of a stream system into segments that have fairly consistent physical and biological characteristics. For descriptions, see "Channel Type Field Guide," Forest Service publication R10-MB-6.

Chargeable volume All volume that is included in the growth and yield projections for the selected management prescriptions used to arrive at the allowable sale quantity, based on required utilizations.

Class (streams) See Stream class.

Class II area (air) Geographic area having air quality exceeding the National Ambient Air Quality Standards, which is designated for a moderate degree of protection from future air quality degradation. Moderate increases in new pollution may be permitted.

Clearance, cultural resources Certification by the Forest Supervisor documenting that the requirements of 36 CFR 800 have been fully met for each undertaking.

Clearcut Harvesting method in which all trees are cleared in one cut. It prepares the area for a new, even-aged stand. The area harvested may be a patch, stand, or strip large enough to be mapped or recorded as a separate age class in planning.

CMAI See Culmination Mean Annual Increment.

CNI Chugach Natives Incorporated, now known as Chugach Alaska Corporation.

Coarse filter An approach used for wildlife conservation management and analysis, which focuses on the characteristics of entire ecosystems and landscapes. See also Fine filter.

Colluvial Soil and material produced by the disintegration and weathering of rocks, including cliff debris, material of avalanches, and alluvium. This material accumulates at the foot of a slope.

Commercial forest land (CFL) Forest land that is producing or is capable of producing crops of industrial wood and (a) has not been withdrawn by Congress, the Secretary, or the Chief; (b) existing technology and knowledge is available to ensure timber production without irreversible damage to soils productivity, or watershed conditions; and (c) existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that adequate restocking can be attained within 5 years after final harvesting.

Commercial timber harvest chargeable Contract sale of commercial timber from suitable timber base.

Commercial timber harvest non-chargeable Contract sale of commercial timber to achieve other resource objectives may be from areas not in suitable Timber base. Includes timber harvested for objectives such as wildlife, ecological needs, salvage, recreation, road corridors, and mineral development.

Commercial special forest products Sale of renewable resources other than timber. Harvest and sale of mushrooms, herbs, medicinal plants and Christmas trees and foliage.

Commodities Resources with monetary (market) or commercial value; all resource products that are articles of commerce, such as timber and minerals.

Common variety Deposits of sand, stone, gravel, and others of widespread occurrence not having distinct special value. These deposits are used generally for construction and decorative purposes and are disposed through sales and purchase under the Materials Act of 1947.

Competitive event Organized events of a temporary nature such as foot, running, horse, vehicle, or boat races, fishing contests and adventure games.

Concern level A measure of the people's concern for the scenic quality of the National Forest applied to travel routes, use areas, and water bodies.

Condemnation In real property law, the process by which property of a private owner is taken for public use, without his/her consent, but upon the award of payment for just compensation.

Confined streams Streams that are confined within their channel banks; they are controlled by stream incision, geomorphic landform characteristics, and local geological conditions.

Confluence The point where two streams meet.

Connectivity A measure of the extent that forest areas between or outside reserves provide habitat for breeding, feeding, dispersal, and movement.

Conservation system unit "The term "conservation system unit" means any unit in Alaska of the National Park system, National Wildlife Refuge System, National wild and Scenic Rivers Systems, National Trails System, national Wilderness Preservation System, or a national Forest monument including existing units, units established, designated, or expanded by or under the provisions of this Act, additions to such units, and any such unit established, designated, or expanded hereafter." (ANILCA, Sec. 102)

Contributed funds Funds used to pay for a portion of the work or materials needed to construct a road only to the standard needed for a timber sale, which could have properly been paid for by purchaser credits, if available.

Control (Nick) points Points in streams that are not easily erodible.

Convey To pass or transmit the title to property from one to another (Black 1979).

Conveyance An instrument by which some estate or interest in lands is transferred from one person to another (Black 1979); a transfer of legal title to land.

Corridor (transportation) A linear strip of land defined for the present or future location of transportation or utility rights-of-way within its boundaries. For planning purposes, potential and proposed corridors are depicted on the Plan map to show approximate corridor routes and widths. Actual corridor routes and boundaries for new systems will be identified through site-specific transportation and/or utility project planning.

Corridor (habitat) Habitats, often linear, that facilitate dispersal and movement of wildlife between larger patches of suitable habitat. See also Connectivity.

Corridor (Wild & Scenic Rivers) Wild, scenic and recreational river corridors are generally comprised of the area within 1/4 mile either side of the ordinary high water mark of the river. River corridor boundaries may be changed as a result of specific river planning following inclusion of the River in the National Wild and Scenic Rivers system.

Cost efficiency The usefulness of specified inputs (costs) to produce specified outputs (benefits). In measuring cost efficiency, some outputs, including environmental, economic, or social impacts, are not assigned monetary values, but are achieved at specified levels in the least cost manner. Cost efficiency is usually measured using present net value, although use of benefit-cost ratios and rates-of-return may be appropriate.

Created opening Openings in the Forest canopy created by silvicultural practices including shelterwood regeneration cutting, clearcutting, seed tree cutting, or group selection cutting.

Critical habitat Specific areas designated as critical by the Secretary of Interior or Commerce for the survival and recovery of species listed as Threatened or Endangered pursuant to the Endangered Species Act.

Crown The tree canopy. The upper part of a tree or woody plant that carries the main branch system and foliage.

Cubic foot Equivalent to a cube of wood with 1-foot sides. The cubic foot volume is a measure of the total sound wood in a tree and is a more accurate depiction of wood volume than the board foot measure. Forest Service policy is that cubic foot measure will be the basis for timber sales by Fiscal Year 1995 (WO Amendment 2400-92-4, 9/30/92).

Cull logs Trees that do not meet certain merchantability specifications.

Culmination of Mean Annual Increment (CMAI) The point at which a tree (or stand) achieves its highest average growth, based on expected growth according to the management intensities and utilization standards assumed in the Forest Plan.

Cultural resources See Heritage resources.

Cumulative effects See Effects.

Cumulative watershed effects (CWE) The effects on a watershed's streams and lakes which result from the incremental impact of individual actions within a watershed when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative watershed effects can result from individually minor but collectively significant actions taking place over a period of time.

D

Day-use facilities Recreation facilities with no overnight camping available, including visitor and information centers.

Decision criteria The rules, standards or guidelines used to evaluate alternatives. They are measurements or indicators that are designed to assist a decision maker in identifying a preferred choice from an array of possible alternatives.

Decks Cut timber, sawlogs, or cull logs that have been removed from logging units and stacked.

Degradation The general lowering of the surface of the land by erosive processes, especially by the removal of material through erosion and transportation by flowing water.

Demand The amount of goods or services that will be consumed if offered over a given range of prices at a particular point in time.

Demographic Pertaining to the study of the characteristics of populations, such as size, growth, density, distribution, and vital statistics.

Departure A timber harvest schedule which deviates from the base harvest schedule for a given alternative so as to result in a planned decline in the timber harvest schedule anytime in the future.

Design capacity The maximum theoretical amount of use or people-at-one-time that a developed recreation site was built to accommodate.

Desired Condition (DC) A portrayal of the land or resource conditions which are expected to result if goals and objectives are fully achieved (draft 36 CFR 219).

Detrimental soil disturbance The condition where established threshold values of soil properties are exceeded and result in significant change or impairment to long-term soil productivity See also Significant change and Significant impairment.

Detritus Material produced by the disintegration and weathering of rocks, that has been moved from its site of origin.

Developed recreation That type of recreation that occurs where modifications (improvements) enhance recreation opportunities and accommodate intensive recreation activities in a defined area.

Developed recreation site Relatively small, distinctly defined area where facilities are provided for concentrated public use, e.g., campgrounds, picnic areas, visitor center.

Diameter at breast height (DBH) The diameter of a standing tree at a point four feet, six inches from ground level.

Discharge velocity The speed of water outflow from a stream or river over a given period of time.

Discount rate The rate used to adjust future benefits or costs to their present value.

Dispersal The movement, usually one-way, of plants and animals from their point of origin to another location where they subsequently produce offspring.

Dispersed recreation That type of recreation use that requires few, if any, improvements and may occur over a wide area. This type of recreation involves activities related to roads, trails and undeveloped waterways and beaches. The activities do not necessarily take place on or adjacent to a road, trail, or waterway, only in conjunction with it. Activities are often day-use oriented and include hunting, fishing, boating, off-road vehicle use, and hiking, among others.

Dispersion To disperse the effects of timber harvest by distributing harvest units more or less uniformly throughout a drainage so that increased runoff and sediment from disturbed sites will be buffered by lower levels of runoff and sediment production from surrounding undisturbed lands.

Dissected landforms A physical, recognizable form or feature of the earth's surface such as a mountain, hill, or valley, having a characteristic shape that in part is the result of several shallow or deeply incised drainage channels.

Distance zone Areas of landscapes denoted by specified distances from the observer (foreground*, middleground*, background*, or unseen*). Used as a frame of reference in which to discuss landscape attributes or the scenic effects of human activities in a landscape. (Words marked by a * have further definitions within the Glossary.)

Disturbance A force that results in changes in the structure and composition through natural events such as wind, fire, flood, avalanche, or mortality caused by insect or disease outbreaks or by human caused events (e.g., timber harvest).

Diversity See Biological diversity.

Down A tree or portion of a tree that is dead and laying on the ground.

Draft Environmental Impact Statement (DEIS) The version of the statement of environmental effects required for major federal actions under Section 102 of the National Environmental Policy Act (NEPA) and released to the public and other agencies for review and comment.

Duff layer The general term for vegetation material covering the mineral soils in forests including the fresh litter and well-decomposed organic material and humus.

Dust, fugitive or Fugitive dust Particulate matter composed primarily of soil which is uncontaminated by industrial activities. Examples are emissions from haul roads and wind erosion.

Dying A standing tree partially dead above ground and likely to die in the future.

E

Easement An interest or right in land owned by another that entitles its holder to a specific limited use.

Ecological amplitude The range of environmental conditions under which a species occurs, representing the species limits of tolerance.

Ecological provinces See Biogeographic provinces.

Ecosystem A complete, interacting system of organisms considered together with their environment (e.g., a marsh, a watershed, or a lake).

Ecosystem management The use of an ecological approach to land management to sustain diverse, healthy and productive ecosystems. Ecosystem management is applied at various scales to blend long-term societal and environmental values in a dynamic manner that may be modified through adaptive management.

Ecotone A transition or junction zone between two or more naturally occurring diverse plant communities (ecosystems).

Edge effect The effect of adjoining vegetative communities on the population structure along the margin, which provides for greater numbers of species and higher population densities than either adjoining community. Edge may also result in negative effects, since habitat along the edge is different than within the patch, reducing the effective area of the habitat patch.

Effect, (in cultural resources) The potential of an undertaking to alter the characteristics that may qualify a property for inclusion in the National Register of Historic Places.

Effects include the following:

- **Direct** Results of an action occurring when and where that action takes place.
- **Indirect** Results of an action occurring at a location other than where the action takes place and/or later in time, but in the reasonably foreseeable future.
- **Cumulative** Results of collective past, present, and reasonably foreseeable future actions.

Electronic sites Locations of communications facilities and/or antennas. Sites include existing facilities or potential sites.

Emergent A plant rooted in shallow water and having most of its vegetation above water (cattails).

Encumbrance A claim, lien, charge, or liability attached to and binding real property (Black 1979).

Endangered species Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Endemic Restricted to a particular locality. For example, a particular species or subspecies may occur on only one or a very few islands.

Enhance To improve, reinforce, enrich or strengthen the existing condition, value, or beauty of a resource.

Entitlement Right to benefits, income or property that may not be abridged without due process (Black 1979).

Environmental analysis An analysis of alternative actions and their predictable short- and long-term environmental effects, incorporating the physical, biological, economic, social and environmental design arts and their interactions.

Environmental Impact Statement (EIS) A document prepared by a federal agency in which anticipated environmental effects of a planned course of action or development are evaluated. A federal statute (Section 102 of the National Environmental Policy Act of 1969) requires that such statements be prepared. It is prepared first in draft or review form, and then in a final form. An impact statement includes the following points: (1) the environmental impact of the proposed action, (2) any adverse impacts which cannot be avoided by the action, (3) the alternative courses of actions, (4) the relationships between local short-term use of the human environment and the maintenance and enhancement of long-term productivity, and (5) a description of the irreversible and irretrievable commitment of resources which would occur if the action were accomplished.

Ephemeral channels A stream that flows in direct response to rainfall and snowmelt but not during dry seasons. Its channel is above the level of the water table.

Equipment fires Those wildland fires originating from the use of equipment in forest operations such as logging, yarding, chainsaws, land clearing, road building, etc.

Erosion The wearing away of the land surface by running water, wind, ice, gravity or other geological activities.

Escapement Adult anadromous fish that escape from all causes of mortality (natural or human-caused) to return to streams to spawn.

Estuary An ecological system at the mouth of a stream where fresh water and salt water mix, and where salt marshes and intertidal mudflats are present. The landward extent of an estuary is the limit of salt-intolerant vegetation, and the seaward extent is a stream's delta at mean low water.

Evaluation A process for interpreting monitoring data and determining whether changes in management direction are warranted.

Evapotranspiration The sum total of water lost from the land by evaporation and plant transpiration. Transpiration is loss of water in vapor form from a plant.

Even-aged management The application of a combination of actions that result in the creation of stands in which trees of essentially the same age grow together. The difference in age between trees in forming the main canopy level of a stand usually does not exceed 20 percent of that age of the stand at harvest rotation age. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

EVOS acquired lands Lands acquired as a part of the *Exxon Valdez* oil spill restoration program.

Exchange A trading of public lands (surface or subsurface estates) that usually do not have high public value for lands in other ownerships that do have value for public use, management, and enjoyment.

Executive Order An order or regulation issued by the President or some administrative authority under his direction.

Existing Scenic Integrity level Indicates the current status of the landscape, the degree of intactness and wholeness of the landscape character, and helps locate and rank areas in need of scenic rehabilitation. It serves as a benchmark for monitoring landscapes to assess changes associated with planned management activities. Scenic Integrity Level is also a measure of the degree of visible disruption of landscape character. See Scenic Integrity Objectives for a description of the 6 levels used to describe the existing scenic integrity level.

F

Facility Structures needed to support the management, protection, and utilization of the National Forests, including buildings, utility systems, dams, and other construction features. There are three types of facilities: recreation, administrative, and permitted.

Falldown The difference between the number of acres planned for timber harvest and those actually harvested, usually experienced as a reduction in acres. Falldown results from many factors, including unmapped unsuitable timberland, newly available information, and project-level consideration of site-specific issues and non-timber resource needs.

FEIS A Final Environmental Impact Statement document. A Final EIS is prepared after review and comment by the public on the Draft EIS.

Feasible Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, technical, and safety factors. In evaluating feasibility, the following are considerations: 1) the effectiveness and practicality of the measures being considered; and, 2) the long- and short-term costs of the measures and the effect of those costs on long- and short-term economic viability of projects or programs.

FHIP See Forest Habitat Integrity Program.

Fine filter An approach used for wildlife conservation management and analysis that focuses on individual species and their habitat needs. See also Coarse filter.

Fire Management Action Plan A plan that provides detailed information for, and guides the implementation of, fire management activities for the approved alternative for the Forest Plan.

Fire severity How hot a fire is for how long. The hotter a fire is and the longer it burns, the more severe it is.

Fire suppression All the work of extinguishing or confining a fire, beginning with its discovery.

Fiscal year (FY) October 1 to September 30 of every year. The Fiscal Year is referred to by the calendar year, which begins on January 1. For example, October 1, 1999, to September 30, 2000, is referred to as Fiscal Year 2000.

Fish habitat improvement projects Structural and non-structural habitat improvement projects such as: fish ladders, in-stream structures, riparian thinning, pruning, seeding, stream bank restorations, fish hatcheries, lake fertilization, fish culture sites and monitoring facilities, aquaculture projects or aquaculture related shore-based facilities.

Fish passage The ability of both adult and juvenile fish to move both up and down stream.

Flash flooding A very rapid responding, relatively high streamflow overtopping the banks in any reach of a stream.

Flood plain That portion of a river valley, adjacent to the river channel, which is covered with water when the river overflows its banks at flood stages in response to a 100-year storm event.

FLPMA Federal Land Planning and Management Act

Fluvial Of, or pertaining to, streams and rivers.

Foodfish Fish consumed by humans.

Footslope The inner, gently inclined surface at the base of a hill or mountain slope. The surface profile is dominantly concave, and is the transition zone between upslope erosional sites and downslope depositional sites.

Forbs A grouping/category of herbaceous plants that are not included in the grass, shrub or tree groupings/categories; generally smaller flowering plants.

Foreground A term used in scenery management to describe viewed landscapes within ½ mile of identified viewing points such as roads, trails, or use sites.

Forest Access Management Plan The plan for the system of access roads, trails, and airfields needed for the protection, administration, and utilization of the National Forests and other lands administered by the Forest Service, or the development and use of resources upon which communities within or adjacent to the National Forests are dependent (36 CFR 212.1). The plan also addresses permanent or temporary road closures necessary for resource protection or public safety.

Forest Facility Master Plan The plan, which depicts the development and management of the Forest's facilities. This includes current volume of business and projections for the future, locations for needed skills to perform program work, existing administrative sites and proposed locations of new sites, and management strategies concerning consolidation or sharing services between units (FSM 7312.1).

Forest Habitat Integrity Program A method of classifying watersheds based on specific resource attributes. The program was developed by the State of Alaska in 1983 based on VCU values developed for the 1979 Tongass Land Management Plan.

Forest health An expression of the relationship among biotic and abiotic influences on the forest (i.e., insects, diseases, atmospheric deposition, silvicultural treatments, harvesting practices, natural disturbance process) and the ability to achieve management objectives for a given forest unit now or in the future, and sustain long-term site productivity.

Forest Plan Source of management direction for an individual Forest specifying activity and output levels for a period of 10-15 years developed to meet the requirements of 36CFR 219. Management direction in the plan is based on the issues identified at the time of the plan's development.

Forest Service recreational cabins Government cabins and shelters for the recreation cabin system.

Forested land Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use.

Forested wetland A wetland whose vegetation is characterized by an overstory of trees that are 20 feet or taller.

Forestwide Standards and Guidelines A set of rules and guidance that directs management activities and establishes the environmental quality, natural renewable and depletable resource requirements, conservation potential, and mitigation measures that apply to several land use designations.

Fragmentation An element of biological diversity that describes the natural condition of habitats in terms of the size of discrete habitat blocks or patches, their distribution, the extent to which they are interconnected, and the effects of management on these natural conditions. Also the process of reducing the size and connectivity of stands within a forest.

Free Use Permit A permit that allows the removal of timber or other resources from public lands free of charge.

Free Use Timber Harvest Refers to the green or dried timber that residents may harvest free of charge for personal use, and not for sale, from National Forests in Alaska. The amount of material granted to any one person in one year shall not exceed 10,000 board feet of saw timber and 25 cords of wood or an equivalent volume in other forms (36 CFR 223.10).

FSH Forest Service Handbook.

FSM Forest Service Manual.

Fuel The organic materials that will support the start and spread of a fire: duff, litter, grass, weeds, forbs, brush, trees, and dead woody materials.

Fuel loading The volume of the available or burnable fuels in a specified area.

Full Service Management Management of developed recreation facilities to provide optimum maintenance, public contacts, and patrolling for public safety and management purposes.

Function A term in ecology referring to the interactions and influences between plant and animal species within an area (how each species uses its environment), and to natural processes of change or disturbance (such as wind or aging).

G

Geographic Information System (GIS) Computer software that links geographic information (where things are) with descriptive information (what things are like).

Geographic provinces Subdivisions of Southeast Alaska used to define natural diversity, including areas with distinctive regional climate, physiography, and geology.

Glacial rivers and streams Rivers and streams that receive their main flow characteristics from the presence and activities of ice and glaciers and their meltwater.

Goal A concise statement that describes a desired future condition normally expressed in broad, general terms that are timeless, in that there is no specific date by which the goal is to be achieved.

Goods and services The various outputs and on-site uses produced from forest resources.

Groundwater Water within the earth that supplies wells and springs. Specifically, water in the zone of saturation where all openings in soils and rocks are filled; the upper surface level forms the water table.

Group selection A harvesting method in which trees are removed in small groups at a time.

Guideline A preferred or advisable course of action that may be followed to achieve forest goals but are optional. Deviations from guidelines would be analyzed during project level analysis and documented in a project decision document but do not require a Forest Plan amendment.

Guyline circle Guylines are cables to brace the tower (spar) used in cable logging systems. Using the tower as the center, the guyline circle is the area between the tower and where the guylines are anchored. For safety reasons, this area is usually cleared of all trees.

H

Habitat The sum total of environmental conditions of a specific place occupied by a wildlife or plant species or a population of each species.

Habitat capability The estimated maximum number of fish or wildlife that can be supported by the amount and distribution of suitable habitat in an area.

Habitat conservation area See Old growth habitat reserve.

Hardened dispersed camping sites Dispersed camping sites where minimal site improvements have been done to protect resources such as gravelling a trail or tent site, installing a fire ring.

Hardrock minerals In general, includes those minerals, which are mined and processed for the recovery of metals such as gold, silver, lead, zinc and copper. Mineral entry can be in the form of location under the U.S. Mining Laws or the Mineral Leasing Act of March 4, 1917.

Hard snags/soft snags Terminology used to describe the state of the decay process in dead trees. Hard snags are dead trees that have little decay and are generally still hard wood. Soft snags are dead trees that have a considerable amount of decay and are generally soft, broken wood.

Haul out Areas used by marine mammals for resting and other social/biological activities, which occur in the intertidal zone.

HCA See Habitat conservation area.

Helicopter landings Helicopter landings associated with permitted special uses. Would include heli-hiking, heli-skiing, helicopter sightseeing tours that are permitted through special uses permits.

Heritage resources The physical remains of districts, sites, structures, buildings, networks, events, or objects used by humans in the past. They may be historic, prehistoric, architectural, or archival in nature. Heritage resources are non-renewable aspects of our national heritage.

Historic property Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places. The term includes artifacts, records, and remains that are related to and located within such properties.

Horizontal distance Distance measured in a flat (horizontal) manner at zero angle.

Hunter day One hunter day is equivalent to one person hunting for any length of time during a 24-hour period.

Hydrologic cycle The complete cycle through which water passes, commencing as atmospheric water vapor, passing into liquid and solid form as precipitation, thence along or into the ground surface, and finally again returning to the form of atmospheric water vapor by means of evaporation and transpiration. Also called Water Cycle.

I

IDT See Interdisciplinary Team.

Ignition The initiation of combustion.

Implementation For cultural resources, that point in an undertaking when the proponent has full and complete authorization to proceed with the undertaking.

Improvements Includes any structures of a permanent nature placed upon the land, which tend to increase its value.

Industrial wood All commercial roundwood products, except fuelwood.

Infrastructure The facilities, utilities, and transportation systems needed to meet public and administrative needs.

Interests Desires of people. See also Interest statement.

Integrated Pest Management (IPM) A process for selecting strategies to regulate forest pests in which all aspects of a pest-host system are studied and weighed. A basic principle in the choice of strategy is that it be ecologically compatible or acceptable. Range of methods used to manage or reduce infestations of forest pests and diseases. Might include silvicultural treatments; harvest, thinning, pruning, burning, chemical or biological treatments.

Intensity How hot a fire is. Specifically, a measure (in BTU's per foot per second) of the energy released per unit of time in an area of actively burning fire. The amount of heat released per foot of fire front per second.

Interception The process by which precipitation is caught and held by foliage, twigs, and branches of trees, shrubs, and other vegetation, and lost by evaporation, never reaching the surface of the ground. Interception equals the precipitation on the vegetation minus stemflow and throughfall.

Interdisciplinary Team (IDT) A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem. Through interaction, participants bring different points of view and a broader range of expertise to bear on the problem.

Interest A general term to denote a right, claim, title, or legal share in real estate (Black 1979).

Interest statement Interest statements and situation statements are defined as issues with respect to NEPA and/or NFMA. They are a summary of all the public issues and concerns. For some of these, the solutions were apparent and there were little differences in a solution, most everyone agreed on a desired outcome. These were the basis for multiple use goals and objectives and Forestwide standards and guidelines. For those interests for which there was a range of possible solutions resulting from differing beliefs and values, situation statements were developed.

Interior old-growth forest The region of a forested stand that has a stable microclimate relative to light, wind, humidity, moisture regime, etc. Natural forest ecotones "seal" a forests edge and stabilize these microclimate features. Ecotones created by management such as the old growth - clearcut edge may have "edge" effects that extend into a forest for several hundred feet (estimated 2-3 tree heights) before stable "interior forest" conditions are achieved and microclimatic effects of the edge are no longer evident.

Inventoried roadless areas Areas identified in a set of inventoried roadless area maps, contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, which are held at the National headquarters office of the Forest Service, or any update or revision of those maps. For more information about roadless area conservation go to: http://roadless.fs.fed.us.

Invertebrate population That population of creatures without a backbone. Context would depict whether land invertebrates, shore invertebrates, or water invertebrates.

Invertebrates Animals without a backbone.

IPM See Integrated Pest Management.

Irretrievable commitments Applies to losses of production or use of renewable natural resources for a period of time. For example, timber production from an area is irretrievably lost during the time an area is allocated to a no-harvest prescription. If the allocation is changed to allow timber harvest, timber production can be resumed. The production lost is irretrievable, but the action is not irreversible.

Irreversible commitments Decisions causing changes, which cannot be reversed. Often applies to nonrenewable resources such as minerals and cultural resources.

Issue A point, matter, or section of public discussion or interest to be addressed or decided. A subject or question of widespread public interest relating to management of the National Forest System. For the purposes of Forest Plan revision on the Chugach National Forest these were further divided into interest statements and situation statements.

K

L

Lacustrine wetland Includes permanently flooded lakes and reservoirs, intermittent lakes, and tidal lakes with ocean-derived salinities of less than 0.5 percent. Typically, there are extensive areas of deep water and there is considerable wave action.

Land allocation The decision to use land for various resource management objectives to best satisfy the issues, concerns and opportunities and meet assigned forest output targets.

Land exchange The conveyance of non-federal land or interests to the United States in exchange for National Forest System land or interests in land.

Landscapes (Chugach) The three primary land areas on the Chugach National Forest: Kenai Peninsula, Prince William Sound and Copper River Delta.

Landscape character Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique. Also referred to as the Existing Landscape Character.

Landscape character goals (also Desired Landscape Character) Elements within a management prescription designed to maintain or modify the existing landscape character to a desired future state.

Land use prescriptions Specific management direction applied to a defined area of land (land use designation as defined in the Revision) to attain multiple use and other goals and objectives.

Land Utilization Project (LUP) A unit designated by the Secretary of Agriculture for conservation and utilization under Title III of the Bankhead-Jones Farm Tenant Act (USDA Forest Service, undated, Land Areas of the National Forest System).

Landform Any physical, recognizable form or feature of the earth's surface, having a characteristic shape, and produced by natural causes. Major forms included are plains, plateaus, and mountains; minor forms are hills, valleys, slopes, eskers, and dunes.

Landslides The moderately rapid to rapid downslope movement of soil and rock materials that may or may not be water-saturated.

Large woody debris (LWD) Any piece of relatively stable woody material, having a diameter of four inches or greater and a length greater than three feet, that intrudes into a stream channel. Formerly called large organic debris.

Leasable minerals Generally includes minerals such as coal, oil, gas, phosphate, sodium, potassium, oil shale, sulfur, and geothermal steam. In addition, on the Chugach National Forest, in the Copper River Addition (ANILCA, Section 502), it also includes minerals such as gold, silver, copper, lead and zinc which are traditionally available under the 1872 Mining Law and were withdrawn by Section 502 of ANILCA.

Lease An authorization (usually long-term) to possess and use public lands or minerals for a fixed period of time.

Leave strips The result of timber harvest activities where blocks of timber are left after harvest has occurred.

Locatable minerals Includes Public Domain minerals commonly known as "hard rock" minerals, such as gold, silver, lead, zinc, copper, and mercury. They are open for location and entry under the United States Mining Laws.

Lodges or resorts Development of major or minor commercial lodge or resort facilities on National Forest System lands.

Log transfer facilities (LTF) Formerly referred to as Terminal Transfer Facilities, Log Transfer Facilities include the site and structures used for moving logs and timber products from land-based transportation forms to water-based transportation forms (or vice versa).

Logging slash The wood residue left on the ground after harvesting. It includes unused logs, uprooted stumps, broken or uprooted stems, tops, branches, and leaves.

Logging systems:

Tractor A system of log transportation in which logs are pulled from the woods to a landing by means of a crawler tractor, skidder, or similar ground-based equipment.

High-lead A system of cable logging in which the working lines are elevated at the landing area by a rigged wooden tree or portable steel spar.

Skyline A system of cable logging in which all or part of the weight of the logs is supported during yarding by a suspended cable.

Balloon A system of cable logging in which the weight of the logs is counteracted by the lift provided by a lighter-than-air balloon.

Helicopter A system of transporting logs from the woods to a landing as an external load on a helicopter.

Long-term sustained yield timber capacity (LTSY) The highest uniform wood yield from suitable-scheduled lands that may be sustained in perpetuity consistent with the Forest Plan.

LTF See Log transfer facilities.

LTSY See Long-term sustained yield timber capacity.

LWD See Large woody debris.

M

Major culvert A culvert that provides an opening of more than 35 square feet in a single installation or in a multiple installation in which the smallest opening is more than 19 square feet.

Managed stand A stand of trees in which stocking level control is applied to achieve maximum growth.

MAI See Mean Annual Increment.

Management area Combinations of adjacent Value Comparison Units having common management direction.

Management concern An issue, problem or a condition that constrains the range of management practices identified by the Forest Service in the planning process.

Management direction A statement of multiple-use and other goals and objectives, the associated land use prescriptions, and standards and guidelines for attaining them.

Management ignited prescribed fire Use of prescribed fire to accomplish resource objectives. Reduce fuel loading. Improve wildlife habitat. Prepare seedbeds.

Management indicators Plant or animal species, communities, or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent.

Management practices The activities applied to a defined area of land (land use designation as defined in the Revision) to attain multiple-use and other goals and objectives.

Management prescription Management practices and intensity selected and scheduled for application on a specific area (e.g., a land use designation) to attain multiple-use and other goals and objectives.

Management requirement Standards for resource protection, vegetation manipulation, silvicultural practices, even-aged management, riparian areas, soil and water and diversity, to be met in accomplishing National Forest System goals and objectives (see 36 CFR 219.17).

Mariculture The cultivation of plants and animals in saltwater, with no freshwater component. Mariculture does not include anadromous fish farming.

Marine systems Of, or belonging to, or caused by, the sea.

Marine transfer facilities Facilities to load and unload passengers, materials, or cargo to and from salt water boats.

Maritime climate Weather conditions controlled by an oceanic environment characterized by small annual temperature ranges and high precipitation.

Mass-wasting A general term for a variety of processes by which large masses of earth material are moved by gravity either slowly or quickly from one place to another.

MBF Thousand Board Feet.

MCF Thousand Cubic Feet.

Mean Annual Increment (MAI) The total increment to a given age in years, divided by that age.

Memorandum of Understanding (MOU) An agreement between the Forest Service and others agencies resulting from consultation between agencies that states specific measures the agencies will follow to accomplish a large or complex project. A memorandum of understanding is not a fund obligating document.

Microclimate The temperature, moisture, wind, pressure, and evaporation (climate) of a very small area that differs from the general climate of the larger surrounding area.

Middleground (Mg) A term used in scenery management to describe viewed landscapes from ½ mile to 3 miles of identified viewing points such as roads, trails, or use sites.

Mineral development The activities and facilities associated with extracting mineral deposits.

Mineral entry Filing a mining claim on public land to obtain the right to mine any minerals it may contain. Also the filing for a mill site on federal land for the purpose of processing off-site minerals. Also includes filing a lease application for minerals available for leasing.

Mineral entry withdrawal Public lands withdrawn from entry under the General Mining Laws and/or the mineral leasing laws. The exclusion of the right of exclusive possession of locatable mineral deposits by the locator and mineral development work. This may include areas required for administrative sites by the Forest Service or areas of high public use.

Mineral exploration The search for valuable minerals.

Mineral lease A lease that authorizes the development and production of leasable minerals from public lands.

Mineral production The extraction of mineral deposits.

Mineral rights The rights of one who owns the mineral estate (subsurface).

Mineral soils Soils consisting predominantly of, and having its properties determined by, mineral matter. These soils usually contain less than 20 percent organic matter, but can contain an organic surface layer up to within 20 inches of the surface.

Mineral withdrawal A formal designation by the Secretary of the Interior, which precludes entry or disposal of mineral commodities under the mining and/or mineral leasing laws.

Minerals activities – locatable The ability to prospect or develop locatable minerals resources such as gold, silver, or copper that are subject to minerals laws regarding claims and long-term development.

Minerals activities – saleable The ability to develop common mineral resources such as gravel or rock resources. These mineral resources may be sold by the Forest or used for forest development activities.

Mining claims A geographic area of the public lands held under the general mining laws in which the right of exclusive possession is vested in the locator of a valuable mineral deposit.

Mitigate To lessen or make minimal the severity. For cultural resources, to lessen or minimize an adverse effect upon a cultural resource listed on or eligible for the National Register of Historic Places. The two categories of mitigation most often used are project modification and data recovery.

Mixed conifer In Southcentral Alaska, mixed conifer stand composition varies by geographic landscape, usually consisting of mountain hemlock, Sitka spruce, black spruce and/or white (Lutz) spruce on the Kenai Peninsula. In Prince William Sound and Copper River areas, mixed conifer stands usually include western hemlock, mountain hemlock, and Sitka spruce species while some individual sites also contain an Alaskan yellow-cedar component.

MBF Thousand Board Feet.

MMBF Million Board Feet.

MMCF Million Cubic Feet.

Modal Relating to the statistical mode.

Mode changes Facilities where changes in transportation occur. Examples: Trailheads, ferry terminals, train depots.

Model An idealized representation of reality developed to describe, analyze, or understand it; a mathematical representation of the relationships under study (e.g., FORPLAN, wildlife habitat capability models).

Moderately well-drained soil Water in these soils is removed from them somewhat slowly, so that the profile is wet for a small, but significant, part of the time.

Moisture regime The variation of moisture content in a specified portion of soil during the year.

Monitoring Gathering information and observing results of management activities to provide a bass for the periodic evaluation of the Forest Plan.

Mop-up Following suppression activities to stop the spread of the fire, the business of extinguishing the fire is called mop-up.

Motorized access for subsistence Access for customary and traditional activities for rural users.

Motorized recreation Recreation activities involving motorized methods for access and transport or in support of an activity. Examples include snowmachine use, ATV/OHV use, etc.

MOU See Memorandum of Understanding.

Multiple-aged stands An intermediate form of stand structure between even- and uneven-aged stands. These stands generally have two or three distinct tree canopy levels occurring within a single stand.

Multiple use The management of all the various renewable surface resources of the National Forest System so that they are used in the combination that will best meet the needs of the American people; harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources.

N

National Cooperative Soil Survey (NCSS) A program consisting of a joint effort of cooperating federal agencies, land-grant universities, and other state and local agencies to map soils, collect soil data, interpret the maps and data, and promote their use. Federal leadership is provided by the National Resource Conservation Service.

National Environmental Policy Act of 1969 (NEPA) An act declaring a National policy to encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and the biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation and to establish a Council on Environmental Quality.

National Fire Management Analysis System (NFMAS) A broad umbrella process to help fire managers identify the most efficient fire program meeting the direction in the Forest plan. This includes information for the planning record on program composition, annual programmed costs, emergency fire fighting costs, expected resource impacts, and net value change. Because of a low wildland fire rate, Region 10 does not use NFMAS but bases outyear budgets on historical needs and inflation.

National Forest Land and Resource Management Plan A plan developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976, that guides all natural resource management activities and establishes management standards and guidelines for the National Forest System lands of a given National Forest.

National Forest Management Act (NFMA) A law passed in 1976 that amends the Forest and Rangeland Renewable Resources Planning Act and requires the preparation of Forest Plans.

National Forest System (NFS) Land Federal lands that have been designated by Executive order or statute as National Forests, National Grasslands, or Purchase Units, or other lands under the administration of the Forest Service.

National Register of Historic Places A register of cultural resources of national, state, or local significance, maintained by the Department of the Interior.

National Wild and Scenic River system Rivers with outstanding scenic, recreational, geological, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act for preservation of their free-flowing condition.

Native selection Application by Native corporations formed under authority of the Alaska Native Claims Settlement Act of 1971 (ANCSA - Public Law 92–203, 85 Stat. 688) and by Native individuals (under Section 14(h)(5), ANCSA) to the USDI Bureau of Land Management (BLM) for conveyance of a portion of lands withdrawn under ANCSA in fulfillment of Native entitlements established under ANCSA. Native village corporations had three years from the date of ANCSA (December 18, 1971) to make their selections and regional corporations had four years. Native individuals who met the criteria had two years from the date of ANCSA to make application under Section 14(h)(5). BLM regulations allowed Native corporations formed under ANCSA to select in excess of their entitlements to ensure sufficient land would be available to meet full entitlement. Remaining lands in excess of entitlement, which have been selected but not conveyed, will revert back to unencumbered National Forest System land status after full entitlement is reached.

Net public benefit The overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index.

Net sawlog volume Trees suitable in size and quality for producing logs that can be processed into lumber. In Southeast Alaska, depending on the market, the volume may be processed as pulp or lumber.

Net willingness-to-pay The amount that a person would have paid for an activity above and beyond what the person actually did pay for that activity.

New FS built roads New road construction by the Forest Service for any purpose. Prescription may specify type. Roads are a general term denoting a way with at least two wheel tracks for purposes of travel by vehicles greater than 50 inches in width.

New roads built by others New road construction by anyone other than the Forest Service, or others for accessing private land, mineral claims, or leaseholdings. Prescription may specify type.

New trails New trail construction. Prescription may specify limits.

No Action Alternative The most likely condition expected to exist in the future if current management direction were to continue unchanged.

No adverse effect When the effect on a cultural resource would not be considered harmful to those characteristics that qualify the property for inclusion in the National Register.

Non-chargeable volume All volume that is not in the growth and yield projections for the selected management prescription used to arrive at the allowable sale quantity.

Noncommercial species Tree species that have no economic values at this time nor anticipated timber value within the near future.

Non-declining even flow A policy governing the volume of timber removed from a National Forest, which states that the volume planned for removal in each succeeding decade will equal or exceed that volume planned for removal in the previous decade.

Nonforest land Land that has never supported forests and lands formerly forested but now developed for such nonforest uses as crops, improved pasture, etc.

Nonmarket value Products derived from National Forest resources that do not have a well-established monetary (market) value, for example, wilderness, wildlife. (Noncash economic benefits.)

Nonmotorized recreation Recreation activities involving nonmotorized methods of access or transport or support for an activity. Examples are hiking, biking, cross-country skiing, dog sledding, etc.

> **Nonmotorized recreation use – summer** The ability of people to recreate during the summer season without motorized equipment (nonmotorized definition, but no distinction between summer and winter).
>
> **Nonmotorized recreation use – winter** The ability of people to recreate during the winter season without motorized equipment (nonmotorized definition, but no distinction between summer and winter).

Nonpoint source (pollution) Unlike point sources of water pollution, nonpoint sources are diffuse and can come from any land area. Nonpoint sources of water pollution originate from many undefinable sources such as agricultural and urban runoff, runoff from construction activities, and runoff from forestry practices. Nonpoint source pollutants are generally carried over or through the soil and ground cover via storm flow processes. The following activities are potential nonpoint sources of pollution; reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvest operations, surface drainage, and road construction and maintenance from which there is natural runoff. Best Management Practices are recognized as control mechanisms for nonpoint source pollution.

Nunatak An isolated hill or peak that projects through the surface of a glacier.

O

Objectives The precise steps to be taken and the resources to be used in achieving goals.

Off Highway Vehicle (OHV) Any vehicle that is restricted by law from operating on public roads for general motor vehicle traffic. Includes motorbikes, minibikes, trailbikes, snowmobiles, dune buggies, all terrain vehicles, and four-wheel drive, high clearance vehicles (FSM 2355.01). Sometimes referred to as Off Road Vehicle or ORV; or All Terrain Vehicle (ATV).

Old-growth forest Ecosystems distinguished by the later stages of forest stand development that differs significantly from younger forests in structure, ecological function, and species composition. Old-growth forest is characterized by a patchy, multi-layered canopy; trees that represent many age classes; large trees that dominate the overstory, large standing dead (snags) or decadent trees; and higher accumulations of large down woody material. The structure and function of an old-growth ecosystem will be influenced by its stand size and landscape position and context.

Old-growth associated species Plant and animal species with habitat relationships that exhibit a strong association with old-growth forests.

Old-growth habitat reserve A contiguous unit of old-growth forest habitat to be managed to maintain the integrity of the old-growth forest ecosystem.

Open road density The length of forest development roads open for public access and use per unit area of land; usually expressed as miles of open road per square mile of land.

Operation and maintenance costs Costs associated with operating and maintaining facilities, program management, and support costs associated with management of other resources.

ORACLE A relational database management system software package.

Order three inventory A level of soil surveys made for extensive land uses that do not require precise knowledge of small areas or detailed soils information. Such survey areas are usually dominated by a single land use and have few subordinate uses. This information can be used in planning for range, forest, recreational areas, and similarly extensive land uses and in community planning.

Order four inventory A soil survey level made for extensive land uses that require general information for broad statements concerning land-use potential and general land management. This information can be used in locating, comparing, and selecting suitable areas for major kinds of land use in regional land-use planning, and in selecting areas for more intensive study and investigation.

Ordinary high water mark The mark along the bank or shore up to which the presence and action of the nontidal water are common and usual, and so long continued in all ordinary years, as to leave a natural line impressed on the bank or shore and indicated by erosion, shelving, changes in soil characteristics, destruction of terrestrial vegetation, or other distinctive physical characteristics. (Consult 11 AAC 53.900 — Alaska Code.)

Organic soils Soils that contain a high percentage (greater than 15 percent) of organic matter throughout the soil depth.

ORV Off Road Vehicle. See Off Highway Vehicle.

Other forest land Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions.

Outfitter/Guide capacity allocation Capacity allocated to Outfitter Guide Services when recreation user capacity has been reached.

Output The measurable goods, end products, or services resulting from management activities that are purchased, consumed, or used directly by people.

Overflow High runoff, which overflows natural stream and river banks. Also known as flooding.

Overlooks Development of scenic vista along roads and trails. Includes tree cutting, turnouts, and trail hardening and widening. May include Nature viewing sites or structures.

Overmature The stage at which a tree declines in vigor and soundness, for example, height growth has usually stopped and probability of mortality is high.

Overselection Unconveyed lands selected in excess of entitlement. Overselections by the State of Alaska are authorized in Section 906 (f), ANILCA. They are authorized for Native Corporations organized under ANCSA in Federal Regulations (43 CFR 2650).

Overstory The portion of trees in a forest that forms the upper most layer of foliage.

P

Palustrine wetland Includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens and all such wetlands that occur in tidal areas where salinity due to ocean derived salts is below 0.5 percent.

PAOT See Persons-at-one-time.

Partial cut Any cutting in which only part of the stand is harvested. This may include thinning, selection, shelterwood, or an overstory removal.

Parts per million (PPM) A measurement of concentration indicating the quantity of a substance per unit volume of a solution.

Party size A component of the Recreation Opportunity Spectrum system and recreation settings. Identifies the maximum number of people allowed in a single group in a given recreation setting.

Patented mining claim A patent is a document that conveys title to land. When patented, a mining claim becomes private property and is land over which the United States has no property rights, except as may be reserved in the patent. After a mining claim is patented, the owner does not have to comply with requirements of the General Mining Law or implementing regulations.

Payments to states A fund consisting of approximately 25 percent of the gross annual timber receipts received by the National Forests in that state. This is returned to the state for use on roads and schools.

Peak flow The highest discharge of water recorded over a specified period of time at a given stream location. Often thought of in terms of spring snowmelt, summer, fall or winter rainy season flows. Also called maximum flow.

Peatland A wetland type (also called "muskeg") in Southeast Alaska that has developed over thousands of years in depressions, or flat areas on gentle to steep slopes. These bogs have poorly drained, acidic, organic soils materials that support vegetation that can be either sphagnum moss or herbaceous plants or sedges, rushes, and forbs or may be a combination of sphagnum moss and herbaceous plants. These vegetation types may have a lesser abundance of shrubs and stunted trees.

Permitted fixed-wing flightseeing landings Landings of fixed-wing aircraft used in conjunction with permitted special uses activities

Personal use timber harvest Personal use refers to the green or dried timber that residents may harvest free of charge for personal use, and not for sale, from National Forests in Alaska. The amount of material granted to any one person in one year shall not exceed 10,000 board feet of saw timber and 25 cords of wood or an equivalent volume in other forms (36 CFR 223.10).

Personal use special forest products Harvest of spruce roots, herbs, medicinal plants, or other renewable resource items for personal use.

Persons-At-One-Time (PAOT) Used to measure how many people at one time can use a recreation facility.

Plan of Operations A plan of operations is required from anyone whose proposed operations, under the 1872 Mining Law, would cause, "significant surface disturbance." (see 36 CFR 228, Subpart A)

Plan period The period of time a Forest Plan is in effect, normally 10 years, but no longer than 15 years.

Planning area The area of the National Forest System controlled by a decision document.

Planning horizon The overall time period considered in the planning process, which spans all activities covered in the analysis or plan and all future conditions and effects of proposed actions that would influence the planning decisions. Generally one decade.

Planning period The time interval within the planning horizon that is used to show incremental changes to yields, costs, effects, and benefits.

Planning records A system that records decisions and activities that result from the process of developing a forest plan, revision, or significant amendment.

Planning units Logical areas identified on alternative maps to apply management prescriptions.

Plant association Climax forest plant community type representing the endpoint of succession.

Plant communities An assemblage of plants that, in general, occur together on similar site conditions.

Point source (pollution) A point at which pollution is added to a system, either instantaneously or continuously. An example is a smokestack.

Pole An immature tree between 5 and 9 inches diameter breast height.

Pollution The presence of matter or energy whose nature, location, or quantity produces undesired environmental effects.

Pond log value Selling value minus manufacturing costs. Pond log values are the price a timber buyer would pay for a log at the mill site.

Poorly drained soils Water in these soils is removed so slowly that the soil remains wet for a large part of the time. The water table is commonly at or near the surface during a considerable part of the year.

Population The actual number of animals or plants present in an area at a certain time that share a common gene pool.

Population viability Probability that a population will persist for a specified period of time across its range despite normal fluctuations in population and environmental conditions.

Positive control The condition that exists when fish and other mobile species are enclosed in an escape-proof barrier for rearing and other clams (bivalves) or aquatic plants are managed for cultivation in unenclosed water.

Potential yield The maximum, perpetual, sustained-yield harvest attainable through intensive forestry on regulated areas considering the productivity of the land, conventional logging technology, standard cultural treatments, and interrelationships with other resource uses and the environment.

Power generation or transmission Hydropower dams, sub stations, transformer sites.

PPM See Parts per million.

Practicable In reference to the Alaska Coastal Management Program, consistent with enforceable policies of approved management programs unless compliance is prohibited based upon the requirements of existing law applicable to the federal agency's operations.

Present Net Value (PNV) The difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the planning area.

Prescribed fire A fire burning under planned conditions to accomplish specific land and resource objectives.

Preservation A technique of conservation that maintains the resource in or on the ground in perpetuity.

Prevention of Significant Deterioration (PSD) The process incorporated in the Clean Air Act which requires emission limitations for certain new or modified sources. See also Class II Area.

Primary succession Vegetation development initiated on newly formed soils or upon surfaces exposed for the first time (as by landslides or retreating glaciers) that have, as a consequence, never borne vegetation before. Any succession beginning on a bare area not previously occupied by plants or animals.

Primitive I ROS class See Recreation Opportunity Spectrum.

Primitive II ROS class See Recreation Opportunity Spectrum.

Priority use A Forest Service commitment to the holder of a permit for outfitting and guiding to give priority consideration to granting the holder a specific amount of available future use.

Process group A combination of similar channel types based on major differences in landform, gradient and channel shapes. (A full description of process groups is located in Appendix D of the Forest Plan.)

Productive old-growth Old-growth forest capable of producing at least 20 cubic feet of wood fiber per acre per year, or having greater than 8,000 board feet per acre.

Programmatic Environmental Impact Statement The document disclosing the environmental consequences of a program or plan which guides or prescribes the use of resources, allocates resources, or establishes rules and policies in contrast to disclosure of the environmental consequences of a site-specific project.

Programmed timber harvest Timber harvest that occurs on suitable forested lands and that is chargeable to (contributes to) the Allowable Sale Quantity.

Project One or more site-specific activities designed to accomplish a specific on-the-ground purpose or result.

Proponent An agency, institution, or individual applying to perform an activity on National Forest System lands under authority of a mining plan of operation, contract, license, special use authorization, or other agreement.

PSD See Prevention of Significant Deterioration.

Public issue A subject or question of widespread public interest relating to management of the National Forest System. For the purposes of Forest Plan revision on the Chugach National Forest these were further divided into interest statements and situation statements.

Public participation Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionnaires, and similar activities designed and held to obtain comments from the public about Forest Service planning.

Purchase unit A unit designated by the Secretary of Agriculture or previously approved by the National Forest Reservation Commission for purposes of Weeks Law acquisition (USDA Forest Service, undated, Land Areas of the National Forest System).

R

Rare plants Plant species with potential conservation concerns, including all plants recognized by the Regional Forester as sensitive, plants designated by the Alaska Natural Heritage Program as G1-G3 S1-S2 that are known from or suspected on the Chugach National Forest, and plants that may be common elsewhere but are suspected to be at the edge of their range or disjunct on the Chugach National Forest.

Real dollar value A monetary value, which compensates for the effects of inflation.

Real Estate (exchange, acquisition) Land available for exchange, allow acquisition of inholdings,

Reburial and reinterment The replacement of disinterred human remains into the ground or otherwise disposing of such remains in a manner likely to approximate the wishes of the deceased (e.g., placement in burial caves, legal cemeteries, surface mortuary structures, or cremation where traditionally practiced).

Reconstruction Road or trail construction activities that take place on an existing road or trail and raise the standard of the road or trail. This can include relocation of the facility in a completely new location.

Recreation capacity The number of people that can take advantage of the supply of a recreation opportunity during an established use period without substantially diminishing the quality of the recreation experience or the resources.

Recreation Opportunity Spectrum (ROS) A system for planning and managing recreation resources that categorizes recreation opportunities into eight classes. Each class is defined in terms of the degree to which it satisfies certain recreation experience needs based on the extent to which the natural environment has been modified, the type of facilities provided, the degree of outdoor skills needed to enjoy the area and the relative density of recreation use. The seven classes are:

> **Primitive I** An unmodified environment generally greater than 5,000 acres in size and located generally at least 3 miles from all roads and other motorized travel routes. A very low interaction between users (generally less than 3 group encounters per day) results in a very high probability of experiencing solitude, freedom, closeness to nature, tranquility, self-reliance, challenge, and risk. Evidence of other users is low. Restrictions and controls are not evident after entering the land unit. Motorized use is rare.

Primitive II An unmodified environment generally greater than 5,000 acres in size and located generally at least 3 miles from all roads and other motorized travel routes. A very low interaction between users (generally less than 3 group encounters per day) results in a very high probability of experiencing solitude, freedom, closeness to nature, tranquility, self-reliance, challenge, and risk. Evidence of other users is low. Restrictions and controls are not evident after entering the land unit. Motorized use is rare. Motorized activities are allowed for traditional and subsistence activities.

Semi-primitive Nonmotorized A natural or natural-appearing environment generally greater than 2,500 acres in size and generally located at least 1/2 mile (greater or less depending on terrain and vegetation, but no less than 1/4 mile) but not further than 3 miles from all roads and other motorized travel routes. Concentration of users is low (generally less than 10 group encounters per day), but there is often evidence of other users. There is a high probability of experiencing solitude, freedom, closeness of nature, tranquility, self-reliance, challenge, and risk. There is a minimum of subtle on-site controls. No roads are present in the area.

Semi-primitive Motorized A natural or natural-appearing environment generally greater than 2,500 acres in size and generally located within 1/2 mile of primitive roads and other motorized travel routes used by motor vehicles; but not closer that 1/2 mile (greater or less depending on terrain and vegetation, but no less than 1/4 mile) from better-than-primitive roads and other motored travel routes. Concentration of users is low (generally less than 10 group encounters per day), but here is often evidence of other users. There is a moderate probability of experiencing solitude, closeness to nature, and tranquility along with a high degree of self-reliance, challenge and risk in using motorized equipment. Local roads may be present, or along saltwater shorelines there may be extensive boat traffic.

Semi-primitive Groups A natural or natural-appearing environment generally smaller than 50 acres in size and generally located within Semi-primitive Nonmotorized or Semi-primitive Motorized areas. Concentration of users may be high (large groups of up to 100 people for short times) and evidence of users is present. There is a low probability of experiencing solitude, closeness to nature, and tranquility. Some site improvements may be present for resource protection when large groups are on-site, a moderate probability at other times. No roads are present and there may be noticeable boat traffic along saltwater shorelines.

Roaded Natural Resource modification and utilization are evident, in a predominantly naturally appearing environment generally occurring within ½ mile (greater or less depending on terrain and vegetation, but no less than ¼ mile) from better-than-primitive roads and other motorized travel routes. Interactions between users may be moderate to high (generally less than 20 group encounters per day), with evidence of other users prevalent. There is an opportunity to affiliate with other users in developed sites but with some chance for privacy. Self-reliance on outdoor skills is only of moderate importance with little opportunity for challenge and risk. Motorized use is allowed.

Roaded Modified Vegetative and landform alterations typically dominate the landscape. There is little on-site control of users except for gated roads. There is moderate evidence of other users on roads (generally less than 20 group encounters per day), and little evidence of others or interactions at campsites. There is opportunity to get away from others but with easy access. Some self-reliance is required in building campsites and use of motorized equipment. A feeling of independence and freedom exists with little challenge and risk. Recreation users will likely encounter timber management activities.

Rural The natural environment is substantially modified by land use activities. Opportunity to observe and affiliate with other users is important as is convenience of facilities. There is little opportunity for challenge and risk and self-reliance on outdoor skills is of little importance. Recreation facilities designed for group use are compatible. Users may have more that 20 group encounters per day.

Urban Urbanized environment with dominant structures, traffic lights and paved streets. May have natural appearing backdrop. Recreation places may be city parks and large resorts. Opportunity to observe and affiliate with other users is very important as is convenience of facilities and recreation opportunities. Interaction between large numbers of users is high. Outdoor skills, risk, and challenge are unimportant except for competitive sports. Intensive on-site controls are numerous.

Maximum ROS class This is the most developed Recreation Opportunity Spectrum (ROS) class that is allowed in the prescription. Less developed ROS classes may occur in the prescription, but no greater development than the maximum ROS Class is allowed.

Recreation places Identified geographical areas having one or more physical characteristics that are particularly attractive to people engaging in recreation activities. They may be beaches, streamside or roadside areas, trail corridors, hunting areas of the immediate area surrounding a lake, cabin site or campground.

Recreation Visitor Day (RVD) A measure of recreation use of an area. One recreation visitor day consists of 12 hours of recreation use of a site or area. Recreation visitor days are used to measure recreation production or output capacity.

Recreational gold panning Hand and small sluice operations.

Reforestation The natural or artificial restocking of an area usually to produce timber and other wood products, but also to protect watersheds, prevent soil erosion, and improve wildlife, recreation and other natural resources. Natural reforestation includes site preparation to reduce competing vegetation and provide a mineral seed bed for seed provided by seed trees. Artificial reforestation is the planting of seedlings, cuttings or seeds by hand or mechanical means and may include site preparation.

Regeneration treatment Treatments and activities that relate to the re-establishment of stands of trees. Includes planting, seeding, and preparing the ground for seeding from adjacent stands where ground preparation is not necessary.

Regulated volume The quantity of timber in the allowable sale quantity that is based on the growth and yield projections for growing stock.

Rehabilitation Actions taken to protect or enhance site productivity, water quality, or other values for a short period of time.

Research design A statement of work to be done toward a particular goal. The research design details what will be done, how it will be done, what is required to do it, and why it is important or useful to do the work .

Research Natural Area (RNA) An area in as near a natural condition as possible, which exemplifies typical or unique vegetation and associated biotic, soil, geologic, and aquatic features. The area is set aside to preserve a representative sample of an ecological community primarily for scientific and educational purposes; commercial and most public uses are not allowed.

Reserve A general term for an area of land recognized for, and managed to preserve or maintain, specific natural features. Wilderness is one common example. In the context of wildlife or fish habitat management, or biological diversity, an area set aside for the maintenance and perpetuation of its habitat or ecosystem features. See also Old-growth habitat reserve and Non-development LUD's.

Reserved right Mineral rights retained by a grantor in a deed conveying land to the United States.

Reserve trees Live or dead trees that are retained for various resource objectives such as wildlife, structural diversity, etc.

Resident fish Fish that are not migratory and complete their entire life cycle in fresh water.

Resource projects On-the-ground field projects to meet land management objectives (soil improvement projects, timber harvest, prescribed fire, etc.)

Resource values The tangible and intangible worth of forest resources.

Responsible official The Forest Service employee who has the delegated authority to make a specific decision.

Restoration The long-term placement of land back into its natural condition or state of productivity.

Revegetation The re-establishment and development of a plant cover. This may take place naturally through the reproductive processes of the existing flora or artificially through the direct action of reforestation or reseeding.

Riffles Shallow rapids in an open stream, where the water surface is broken by waves caused by wholly or partially submerged obstructions.

Right-of-Way An easement, license, or permit to pass through another person's land. It does not grant an estate of any kind, only the right to use.

Riparian area The area including a stream channel, lake or estuary bed, the water itself, and the plants that grow in the water and on the land next to the water.

Riparian corridor The floodplain and associated riparian soils, vegetation, and wetlands.

Riparian ecosystem Land next to water where plants that are dependent on a perpetual source of water occur.

Riparian management area Land areas delineated in the Forest Plan to provide for the management of riparian resources. Specific standards and guidelines, by stream process group, are associated with riparian management areas. Riparian management areas may be modified by watershed analysis.

Riverine wetland A category in wetland classification which includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens; and, (2) habitats with water containing ocean-derived salts in excess of 0.5 percent.

RNA See Research Natural Area.

Road A motor vehicle travel way over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified or temporary.

> **Classified Roads** Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including state roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service.

Unclassified Roads Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization.

Temporary Roads Roads authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be part of the forest transportation system and not necessary for long-term resource management.

Road decommissioning Activities that result in the stabilization and restoration of unneeded roads to a more natural state.

Road density The number of road miles per square mile of land area.

Roadless area An area of undeveloped public land within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use.

Road maintenance level Defines the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria (FSH 7709.58, section 12.3).

Maintenance Level 1 Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period is one year or longer. Basic custodial maintenance is performed.

Maintenance Level 2 Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration.

Maintenance Level 3 Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities.

Maintenance Level 4 Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds.

Maintenance Level 5 Assigned to roads that provide a high degree of user comfort and convenience. Normally, roads are double-laned and paved, or aggregate surfaced with dust abatement.

Road management objectives Define the intended purpose of an individual road based on management area direction and access management objectives. Road management objectives, design criteria, operation criteria, and maintenance criteria.

ROS See Recreation Opportunity Spectrum.

ROS inventoried A general inventory of the physical, social and managerial setting for recreation, based on remoteness from modern human development and activity, modification of the land, and social factors such as crowding. See also Recreation Opportunity Spectrum.

Rotation The planned number of years between the formation or the regeneration of a crop or stand of trees and its final cutting at a specified stage of maturity.

Rotation age The age of a stand when harvested at the end of a rotation.

RPA Forest and Rangeland Renewable Resources Planning Act.

RPA Assessment and Program The RPA Assessment is prepared every ten years and describes the potential of the nation's forests and rangelands to provide a sustained flow of goods and services. The RPA Program is prepared every five years to chart the long-term course of Forest Service management of the National Forests, assistance to state and private landowners, and research. They are prepared in response to Sections 3 and 4 of the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) (16 U.S.C. 1601).

Rural development Rural Development is the management of human, natural, technical, and financial resources needed to improve living conditions, provide employment opportunities, enrich the cultural life, and enhance the environment of rural America. In the National Forest System, rural development is accomplished through partnerships.

S

Saleable minerals Include common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay. In general, these minerals are of widespread occurrence and are of relatively low unit value. They are generally used for construction materials and for road building purposes.

Salvage harvest Removal of dead or dying trees resulting from insect and disease epidemics or wildfire.

Saturated soils Soil condition where all the spaces between soil particles are filled with water.

Sawlogs (Sawtimber) That portion of a tree that is suitable in size and quality for the production of dimension lumber, collectively known as sawtimber.

Scenery Management System (SMS) A methodology to objectively assess scenic resources and develop management objectives to manage the scenery resource into the future.

Scenic attractiveness An indicator of the inherent scenic beauty of a landscape based on human perceptions of the intrinsic beauty of landform, rockform, waterform, and vegetation pattern. Attributes of variety, unity, vividness, intactness, coherence, mystery, uniqueness, harmony, balance and pattern can enhance scenic attractiveness. There are three Scenic Attractiveness classes:

Class A – Distinctive

Class B – Typical

Class C – Undistinguished

Scenic classes A classification of scenic landscapes describing the relative importance or value of a particular landscape for scenery.

Scenic Integrity Objective (SIO) Identifies the specific management direction for managing scenery in relation to the Landscape Character. The SIO establishes the maximum degree of deviation allowed in the Landscape Character. These following descriptions are used to describe the existing scenic integrity level. There are six Scenic Integrity Objectives:

> **Very High** The valued landscape character is intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level.
>
> **High** The valued landscape character appears intact. Deviations may be present but must repeat the form, line, color, texture and pattern common to the landscape character so that they are not evident.
>
> **Moderate** The valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed.
>
> **Low** The valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed, but they borrow valued attributes such as size, shape, edge effect, and pattern of natural openings, changes in vegetation types, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed, but compatible or complementary to the character within.
>
> **Very Low** The valued landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character. They many not borrow from valued attributes such as size, shape, edge effect, pattern of natural openings, changes in vegetation type, or architectural styles within or outside the landscape being viewed. However, deviations must be shaped by and blend with the natural terrain so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.
>
> **Unacceptably Low** The valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern, or scale from the landscape character. Landscapes at this level of integrity need to be rehabilitated. This level should only be used to inventory existing integrity. It must not be use as a management reference.
>
> **Minimum SIO** The minimum Scenery Integrity Objective to be achieved by the prescription. Greater scenic integrity objectives may be achieved, but it may not be degraded below the minimum SIO.

Scoping Determination of the significant issues to be addressed in an environmental impact statement.

Scree An accumulation of loose stones or rock debris lying on a slope or at the base of a cliff.

Scrub-shrub wetland Wetlands dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions such as poor soil drainage.

Second growth Forest growth that has regenerated naturally or has been planted after some drastic interference (for example, clearcut harvest, serious fire, or insect attack) with the previous forest growth.

Secondary channel Lateral channel with an axis of flow roughly parallel to the mainstem and fed by the mainstem.

Secondary stream production Results from consumption by animals of materials produced in primary production in streams; this includes production of macroinvertebrates and some fish species.

Secondary succession The process of reestablishing vegetation after normal succession is disrupted by fire, cultivation, lumbering, windthrow, or any similar disturbance.

Sediment Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

Seed tree Small number of seed-bearing trees left singly or in small groups after timber harvest to provide seed for regeneration of the site.

Selection cutting A silvicultural system used to create or maintain uneven-aged stands, usually by the periodic removal of groups of trees or individual trees. It is undertaken to provide periodic harvests while maintaining full residual stand growth rates. It attempts to develop a balanced uneven-aged stand structure, including the encouragement of regeneration by providing the cultural measures needed for tree growth and seedling establishment. The selection system refers to the programs used to create or maintain the stand, while the selection method refers to the way in which the stand is regenerated. The cutting usually involves a mixture of regeneration and improvement cuts. Note that selection cutting is not the same thing as selective cutting (logging). See also Selective cutting.

Selective cutting A system in which groups of trees or individual trees are removed periodically from the forest based on economic criteria aimed at maximizing logging revenues rather than the need to ensure satisfactory regeneration or to maintain stand growth rates and quality of timber production. The term is often used synonymously with selection cutting, but this is seldom correct, since the management goals of the two systems differ. Selective cutting provides periodic revenues from the forest but is not specifically designed to improve the growing conditions of the trees remaining. The practice of selective cutting has historically resulted in the selection of all the biggest and best trees for cutting, leaving behind a silvicultural slum of damaged trees and degraded ecosystem functions. See also High grade and Selection cutting.

Sensitive species Plant or animal species, which are susceptible or vulnerable to habitat alterations or management activities resulting in a viability concern for the species long-term persistence. Sensitive species may be those species under consideration for official listing as endangered or threatened species, that are on an official state list, or that are recognized by the Regional Forester as needing special consideration to assure viable populations and to prevent their being placed on federal or state lists.

Sensitive travel route A road system or marine waterway that receives a moderate to high degree of use by the public, both Alaskan residents and tourists.

Sensitivity zone A body of land, which has been classified on the basis of cultural and environmental data, as having a high, medium, or low likelihood for containing cultural resources.

Settlement sale The disposition of timber or other national forest products, cut, damaged or destroyed in conjunction with an authorized occupancy of a right-of-way or other use of National Forest Land. In wilderness it would be the sale of timber removed from an inholding access road or privately developed hatchery site. Also, the compensation of the United States for property taken or rendered unusable for other purposes incidental to some lawful use of National Forest land. When timber has a value, clearing the land for some use other than growing timber constitutes a forced sale.

Shelterwood harvest The removal of a stand of trees through a series of cuttings designed to establish a new crop with seed and protection provided by a portion of the stand.

SHPO See State Historic Preservation Officer.

Side-slope break The abrupt change (usually decreases) in slope gradient defining the upper limit of channel incision.

Significant change (Soils) Change in productivity of the land as indicated by changes in soil properties that are expected to result in a reduced productive capacity over the planning horizon. Based on available research and current technology, a guideline of 15 percent reduction in inherent soil productivity potential is used as a basis for setting threshold values for measurable or observable soil properties or conditions. The threshold values, along with areal extent limits, will serve as an early warning signal of reduced productive capacity. A more stringent basis than 15 percent can be used where appropriate and documented.

Significant impairment (Soils) Changes in the productivity of the land as indicated by changes in soil properties which would result in significant changes in the inherent productive capacity that last beyond the planning horizon.

Significant surface disturbance (Mining operations) changing the above-ground environment so much that returning that site to the condition it was in before the change is difficult or impossible. Road construction, use of mechanical earthmoving equipment including backhoes and bulldozers, construction of buildings, and cutting of timber are all examples of activities that are considered to cause significant disturbance to surface resources. An evaluation of proposed operations must be made on a case-by-case basis to determine if disturbance is considered significant. For example, a mining activity in an alpine area may result in significant disturbance that takes years to reclaim while the same activity conducted at a lower elevation where natural conditions are not as severe may result in a disturbance that would take only a few months to successfully reclaim.

Silvicultural system A management process whereby forests are tended, harvested, and replaced resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the process. See also Single-tree selection, Shelterwood cutting, Group selection, Even-aged management, Uneven-aged management, Two-aged management, and Clearcut.

Silviculture The science and art of growing and tending crops of forest trees to attain the desired level of marketable and unmarketable products.

Single-tree selection A cutting method to develop and maintain uneven-aged stands by removal of selected trees from specified age classes over the entire stand area in order to meet a predetermined goal of age distribution and species in the remaining stand.

Site index A measure of the relative productive capacity of an area for growing wood. Measurement of site index is based on height of the dominant trees in a stand at a given age.

Site preparation Removing unwanted vegetation and debris from a site and preparing the soil before reforestation.

Site-potential tree height The average height of a given species of tree when mature on a given site.

Site productivity Production capability of specific areas of land.

Situation statements Situation statements are defined as issues with respect to NEPA and/or NFMA. They represent one or more interests in which there is either a conflict or range of improvements within the interest or between one or more interests. The situation statements express the conflict or range of solutions and try to identify the problem. The situation statements represent fundamental mutual differences in how the public felt the land should be managed. They reflect deeply held values for which there exists a broad range of alternative ways to address the differences. The situation statements identify the major interests that can be addressed through management prescriptions and land use allocations. Interests were developed from the public comments received. Different alternatives address these different situations to varying degrees.

Size class For the purposes of forest planning, size class refers to the three intervals of tree stem diameter used for classification of timber in the Forest Plan database. Less than five-inch diameter = seedling/sapling. Five to seven-inch diameter = pole timber. Greater than seven-inch diameter = sawtimber.

Skyline logging See "Logging systems".

Slash Debris left after logging, pruning, thinning, or brush cutting, and large accumulations of debris resulting from windstorms. It includes logs, bark, branches, and stumps.

Slope distance Distance measured along the contour of the ground.

Slough A section of an abandoned river channel containing stagnant water and occurring on a flood plain or delta.

Smolt A young silvery-colored salmon or trout that moves from freshwater streams to saltwater.

Snag A non-living standing tree usually greater than 5 feet tall and 6 inches in diameter at breast height. The interior of the snag may be sound or rotted.

Soft snag A snag composed primarily of wood in advanced stages of decay and deterioration; particularly in the sapwood portion; generally not merchantable.

Soil and watershed improvement projects Included are landslide stabilization, stream bank stabilization, roadside seeding, application of Best Management Practices, culvert maintenance, improving soil quality by mechanical treatments, chemical or other soil additives, irrigation or vegetative manipulation.

Soil conservation practices Practices that are mechanisms used to protect soil quality while managing for other resource goals and objectives. They can be administrative, preventive or corrective measures. They are identified during project planning and design.

Soil drainage The rapidity and extent of the removal of water from the soil, in relation to additions especially by surface runoff and by flow through the soil to underground spaces.

Soil productivity The capacity of a soil, in its normal environment, to produce a specific plant or sequence of plants under a specific system of management.

Soil quality standards Standards that are a combination of 1) “threshold” values for severity of soil property alteration, or significant change in soil properties conditions, and 2) areal extent of disturbance.

Soil Resource Inventory (SRI) An inventory of the soil resource based on landform, vegetative characteristics, soil characteristics, and management potentials.

Somewhat poorly drained soil Water in the soil is removed from the soil slowly enough to keep it wet for significant periods but not all of the time.

Special habitats Structural elements of ecosystems. These may include, but are not limited to: snags, spawning gravels, fallen trees, aquatic reefs, caves, seeps, and springs.

Special interest areas A designation for areas possessing unique or unusual scenic, historic, prehistoric, geodesic scientific, or other characteristics.

Special use authorization A permit, term permit, temporary permit, lease, or easement that allows occupancy or use of, or rights and privileges on National Forest System lands.

Special use permit Permits and granting of easements (excluding road permits and highway easements) authorizing the occupancy and use of land.

Specified road Those roads including related transportation facilities and appurtenances, listed in timber sale contracts for construction or reconstruction by the timber purchaser in accordance with locations and specifications provided by the Forest Service. Those Forest Development roads planned for recurrent land management uses and for which the timber sale contract species the location, standards, and specifications.

Split lines The process of separating the direction of timber harvest yarding into opposite directions.

SRI See Soil Resources Inventory.

Stabilization The process of arresting the deterioration of a damaged cultural resource in order to prevent further damage from occurring. Stabilization may include reconstructing portions of the cultural resource.

Stand A group of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition as to be distinguishable from the trees in adjoining areas.

Standard A course of action or level of attainment required by the forest plan to promote achievement of goals and objectives.

State Historic Preservation Officer (SHPO) The official appointed or designated pursuant to Section 101(b)(1) of the National Historic Preservation Act of 1966, as amended, to administer the State Historic Preservation Program.

State selection (from National Forest System lands) Application by Alaska Department of Natural Resources to the USDI Bureau of Land Management for conveyance of a portion of the 400,000 acre state entitlement from vacant and unappropriated National Forest System lands in Alaska, under authority of Section 6(a) of the Alaska Statehood Act of 1959 (Public Law 85-508, 72 Stat. 340). For lands to be conveyed, state selections must be approved by the USDA Forest Service, Regional Forester, Alaska Region under criteria of the statehood Act. Until approved by the Regional Forester, the state application is not considered a valid selection. The state can select up to 25 percent in excess of its remaining entitlement.

Stewardship harvest Timber harvested to benefit other resources such as, wildlife habitat improvement, fuels reduction, and ecosystem diversity.

Stream bed The substrate plane bounded by the stream banks, over which the water column moves. Also called the stream bottom.

Stream bank The portion of the channel cross-section that restricts lateral movement of water at normal water levels. The bank often has a gradient steeper than 45 degrees and exhibits a distinct break in slope from the stream bottom. An obvious change in substrate may be a reliable delineation of the bank.

Stream class A means to categorize stream channels based on their fish production values. There are four stream classes on the Tongass National Forest. They are:

> **Class I** Streams and lakes with anadromous or adfluvial fish habitat; or high quality resident fish waters listed in Appendix 68.1, Region 10 Aquatic Habitat Management Handbook (FSH 2609.24), June 1986; or habitat above fish migration barriers known to be reasonable enhancement opportunities for anadromous fish.
>
> **Class II** Streams and lakes with resident fish populations and generally steep (6-15 percent) gradient (can also include streams from 0-5 percent gradient) where no anadromous fish occur, and otherwise not meeting Class I criteria. These populations have limited fisheries values and generally occur upstream of migration barriers or have other habitat features that preclude anadromous fish use.
>
> **Class III** Perennial and intermittent streams with no fish populations but which have sufficient flow or transport sufficient sediment and debris to have an immediate influence on downstream water quality or fish habitat capability. These streams generally have bankfull widths greater than 5 feet and are highly incised into the surrounding hillslope.

Class IV Intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to have an immediate influence on downstream water quality or fish habitat capability. These streams generally are shallowly incised into the surrounding hillslope.

Non-streams Rills and other watercourses, generally intermittent and less that 1 foot in bankfull width, little or no incisement into the surrounding hillslope, and with little or no evidence of scour.

Streamflow The discharge of water from a watershed that occurs in a natural stream channel.

Stream order First order streams are the smallest unbranched tributaries; second order streams are initiated by the point where two first order streams meet; third order streams are initiated by the point where two second order streams meet, and so on.

Structure A term in ecology referring to the arrangement of plant communities or ecosystems across a landscape and how they are connected, and to variations in tree heights and diameters within a stand or between stands.

Subsistence Section 803 of the Alaska National Interest Lands Conservation Act defines subsistence use as, "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade."

Subspecies An aggregate of similar populations of a species generally inhabiting a geographic subdivision of the range of the species and differing taxonomically (e.g., different size or color) from other populations of the species.

Substrate The size of rock in the bed (bottom) of rivers and streams.

Suitable forest land Forest land for which technology is available that will ensure timber production without irreversible resource damage to soils, productivity, or watershed conditions, and for which there is reasonable assurance that such lands can be adequately restocked, and for which there is management direction that indicated that timber production is an appropriate use of that area.

Summer use period Recreational use during the summer months, generally April 30 until the Wednesday before Thanksgiving.

SUP destination lodges Development of commercial lodge facilities on National Forest System lands under a special use permit.

SUP fixed-wing flightseeing landings Landings of fixed-wing aircraft used in conjunction with permitted special uses activities.

SUP helicopter landings Helicopter landings associated with permitted special uses. Would include heli-hiking, heli-skiing, or helicopter sightseeing tours that are permitted through special uses permits.

SUP Hut-to-Hut type recreation cabins Cabins and shelters constructed for lodging in conjunction with permitted special uses recreation activities.

SUP recreation equipment storage/cache Equipment stored or cached on National Forest lands used in conjunction with permitted special uses activities.

Suppression The act of extinguishing or confining a fire.

Surface rights All rights in the surface of the land except oil, gas, and other mineral or subsurface rights.

Suspended sediment The very fine soil particles that remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.

Sustained yield The amount of renewable resources that can be produced continuously at a given intensity of management.

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Temporary facility Any structure or other human-made improvement that can be readily and completely dismantled and removed from the site when the authorized use terminates.

Temporary roads Low-level roads constructed for a single purpose and short-term use. Once use of the road has been completed, it is obliterated, and the land it occupied is returned to production.

Tentatively suitable forest land Forest land that is producing or is capable of producing crops of industrial wood and: (a) has not been withdrawn by Congress, the Secretary of Agriculture or the Chief of the Forest Service; (b) existing technology and knowledge is available to ensure timber production without irreversible damage to soils productivity, or watershed conditions; (c) existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that it is possible to restock adequately within 5 years after final harvest; and (d) adequate information is available to project responses to timber management activities.

Terrestrial ecosystems Plant communities that are not dependent on a perpetual source of water to grow.

Thinning The practice of removing some of the trees in a stand so that the remaining trees will grow faster due to reduced competition for nutrients, water, and sunlight. Thinning may also be done to change the characteristics of a stand for wildlife or other purposes. Thinning may be done at two different stages:

Precommercial Removing trees that are too small to make a merchantable product to improve tree spacing and promote more rapid growth.

Commercial Removing trees that have reached sufficient size to be manufactured into a product to improve tree spacing and promote more rapid growth.

Threatened species A plant or animal species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Threatened species are identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Threshold The point or level of activity beyond which an undesirable set of responses begins to take place within a given resource system.

Tiering Elimination of repetitive discussions of the same issue by incorporating by reference the general discussion in an environmental impact statement of broader scope. For example, a project environmental assessment could be tiered to the Forest Plan EIS.

Timber A general term for the major woody growth of vegetation in a forest area.

Timber classification Forested land is classified under each of the land management alternatives according to how it relates to the management of the timber resource. The following are definitions of timber classifications used for this purpose.

Nonforest Land that has never supported forests and land formerly forested where use for timber production is precluded by development or other uses.

Forest land Land at least 10-percent stocked (based on crown cover) by forest trees of any size, or formerly having had such tree cover and not currently developed for nonforest use.

Suitable land Land to be managed for timber production on a regulated basis.

Unsuitable Forest land withdrawn from timber utilization by statute or administrative regulation (for example, wilderness), or identified as inappropriate for timber production in the Forest planning process.

Commercial forest Forest land tentatively suitable for the production of continuous crops of timber and that has not been withdrawn.

Timber dispersion When an opening created from a final timber harvest is no longer considered an opening for the purpose of scheduling adjacent timber harvest. This is often expressed as the maximum amount of disturbance in a watershed at any given time.

Timber harvest schedule The quantity of timber planned for sale and harvest, by time period, from the area of land covered by the Forest Plan.

Timberlands Forest lands producing or capable of producing crops of industrial wood. Areas qualifying as timberland can produce more than 20 cubic feet per acre per year of industrial wood at culmination of mean annual increment.

Timber production The purposeful growing, tending, harvesting, and regeneration of trees for industrial or consumer use.

Timber Stand Improvement (TSI) All noncommercial intermediate cuttings and other treatments to improve composition, condition, and volume growth of a timber stand.

Top filing The filing of a future selection application by the State of Alaska, subject to valid existing rights, for lands which are not available for selection on the date of filing. If otherwise valid, these applications become an effective selection, without further action by the state, upon the date included lands become available for selection. Top filings for the State of Alaska are authorized by Section 906(e), ANILCA.

Total stream discharge Total water outflow from stream or river.

Traditional activities Traditional activities refer to activities in Conservation System Units as specified in the Alaska National Interest Lands Conservation Act, Section 1110.

> The Forest Service Manual (FSM 2326.1-6) defines traditional activities to include, but are not limited to, recreation activities such as fishing, hunting, boating, sightseeing, and hiking. Such uses are subject to reasonable regulation to protect natural and other values of wilderness from damage. Traditional activities, which are legal, shall be allowed to continue in Wildernesses where such use has occurred, and no proof of pre-existing use will be required in order to use a snowmachine, motorboat, or airplane. No permits will be required in order to use a snowmachine, motorboat, or airplane. No permits will be required by the general pubic to use these specific types of motorized transport or nonmotorized surface transportation methods for traditional activities that are otherwise allowed in areas not specifically closed to their use.

Traffic Service Level (TSL) Describes a road's significant traffic characteristics and operating conditions. The levels reflect a number of factors, such as speed, travel time, traffic interruptions, freedom to maneuver, safety driver comfort, convenience, and operating costs. These factors, in turn, affect design elements such as number of lanes, turnout pacing, lane widths, type of driving surface, sight distances, design speed, clearance, horizontal and vertical alignment, curve widening, and turnarounds.

TSL A Reflects transportation efficiency and mobility with few interruptions to flow and a stable smooth driving surface.

TSL B Generally would have alignment more influenced by topography, more interruptions but still usually a stable smooth driving surface.

TSL C One could expect much more sinuous alignment to reduce construction costs with a surface that may not be stable under all traffic or weather conditions.

TSL D Generally constructed for a single purpose and traffic is discouraged for other purposes; surface and alignment is rough and irregular; very low speeds are anticipated to be able to safely negotiate the road.

Transportation and Utility System (TUS) Significant corridors, with their associated sites used to accommodate public transportation and energy transmission needs.

Avoidance Area An area where the establishment and use of transportation or utility corridors and sites is not desirable given the land use designation emphasis. A search for "windows" should be exhausted before TUS facilities are considered in avoidance areas. When practical, these areas should be avoided through site-specific analysis during project-level planning. Avoidance areas often include congressionally and administratively designated areas. Although special environmental and procedural considerations may be required for these areas, these special designations do not preclude consideration and use as a TUS. Avoidance areas are designated through the allocation of lands to management prescriptions specifically identified as TUS avoidance areas in their standards and guidelines.

Exclusion Area A large area (large enough to cause significant barriers), which legislatively precludes transportation and utility systems. Due to special authorities provided in Title XI, ANILCA, there will be no exclusion areas on the Tongass.

Window An area potentially available for the location of transportation or utility corridors and sites.

Transportation/Utility corridor A linear strip of land identified for the present location of transportation or utility rights-of-way within its boundaries (USDA Forest Service, Region 6 memo dated December 2, 1987 from Director of Lands and Minerals to Director of Planning).

Trust A right of property, real or personal, held by one party for the benefit of another.

TSI See Timber Stand Improvement.

TSL See Traffic Service Level.

TTRA Tongass Timber Reform Act of 1990.

Turbidity An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a water sample; turbidity in water is caused by the presence of suspended matter such as clay, silt, finely divided organic and inorganic matter, plankton, and other microscopic organisms.

TUS See Transportation and Utility System.

Two-aged management A silvicultural method in which the majority of the trees in a harvest unit are cut in one entry, and the rest are left as residual trees, either singly or in patches. The residual trees remain unharvested to provide structural diversity and older-aged trees within the second-growth stand. See "Two-aged System" in the Forest Products Forestwide standards and guidelines for guidance.

Type conversion The act of converting a plant community from one vegetative type to another. In forestry, it is the act of changing the existing dominant tree species from one type to another.

U

Unconfined streams Streams that, due to lack of stream incision, and effects of geomorphic landform characteristics and local geologic conditions, result in streams overflowing their banks, changing flows to other channels, and establishing new channels during flood conditions.

Understory vegetation Grass, small trees, shrubs, and other plants found beneath the overstory (the trees comprising the forest).

Undertaking In cultural resources, any project, activity, or program that can result in changes in the character or use of historic properties, if any such properties are located in the area of potential effects. The project, activity, or program must be under the direct or indirect jurisdiction of a federal agency or be licensed or assisted by a federal agency. Undertakings include new and continuing projects, activities, or programs and any of their elements not previously considered under Section 106, National Historic Preservation Act of 1966, as amended.

Uneven-aged management The application of actions needed to maintain high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes. Cutting methods that develop and maintain uneven-aged stands are single-tree and group selection.

Unprogrammed timber harvest Timber harvest that occurs on unsuitable forested lands and is not chargeable to (does not contribute to) the Allowable Sale Quantity.

Unseen Areas of the landscape that are seldom seen or infrequently viewed by the public. It is recognized that all landscapes are viewed from the air.

Unsuitable lands Forest land not managed for timber production because: 1) Congress, the Secretary, or the Chief has withdrawn it; 2) it is not producing or capable of producing industrial wood; 3) technology is not available to prevent irreversible damage to soils productivity, or watershed conditions; 4) there is no reasonable assurance, based on existing technology and knowledge, that it is possible to restock lands within 5 years after final harvest; 5) there is, at present, a lack of adequate information about responses to timber management activities; or, 6) timber management is inconsistent with or not cost efficient in meeting the management requirements and multiple-use objectives specified in the Forest Plan.

Unsuppressed A wildland fire that has not been controlled.

Upland Not immediately adjacent to a stream.

Utility corridor Corridors for transmission lines, cables, pipelines, and major highways.

Utility systems Hydropower dams, sub-stations, transformer sites, corridors for transmission lines, cables, pipelines, etc. and roads or trails for installation and maintenance.

Utility volume Logs that do not meet minimum requirements for sawtimber but are suitable for the production of usable chips.

Utilization standards Standards guiding the use and removal of timber. They are measured in terms of diameter at breast height (DBH), top of the tree inside the bark (top DIB), and the percentages of "soundness" of the wood.

V

Valid Having legal strength or force, executed with proper formalities, incapable of being rightfully overthrown or set aside (Black 1979).

Vegetation management Projects that alter the vegetation composition, such as: thinning, pruning, clear-cutting, prescribed fire, planting, and fertilization to improve forest health or biodiversity. Improving stand conditions of young stands in non-timber development prescriptions.

Vegetation release The freeing of vegetation (grass, forbs, brush, trees) by eliminating the competition for nutrients, water, and sunlight. Once competition for these items has been eliminated, subdued, or stagnated, vegetation will display vigor and growth.

Veneer log A log considered suitable in size and quality for producing veneer, which is a thin sheet of wood of uniform thickness.

Very poorly drained soils Water is removed from the soil so slowly that the water table remains at or on the surface the greater part of the time. Soils of this drainage class usually occupy level or depressed sites and are frequently ponded.

Viable population For forest planning purposes a fish or wildlife population that has the estimated number and distribution of reproductive individuals to insure its continued existence is well distributed in the National Forest.

Viewing sites Development of scenic vistas along roads and trails. Includes tree cutting, turnouts, and trail hardening and widening. May include Naturewatch viewing sites or structures.

Viewshed An expansive landscape or panoramic vista seen from a road, marine water way or specific viewpoint.

V-notches A deeply incised valley along some waterways that would look like a "V" from a frontal view. These abrupt changes in terrain features are often used as harvest unit or yarding boundaries.

Volume class Average stand volume usually given as net board feet per acre. Scribner Rule, on the Tongass and Chugach National Forests.

Volume strata Divisions of old-growth timber volume derived from the interpreted timber type data layer (TIMTYP) and the common land unit data layer (CLU). Three volume strata (low, medium, and high) are recognized in the Forest Plan for each Administrative Area.

W

WAA See Wildlife analysis area.

WARS Wilderness attribute rating system (RARE II).

Watershed The area that contributes water to a drainage or stream. Portion of the forest in which all surface water drains to a common point. Watersheds can range from tens of acres that drain a single small intermittent stream to many thousands of acres for a stream that drains hundreds of connected intermittent and perennial streams.

> **Third order watershed**. A watershed where there are (generally) two major branches to the mainstream of the watershed. See also Stream order.

Fourth order watershed. A watershed that contains at least two third order watersheds.

Watershed analysis A systematic procedure for characterizing and evaluating ecological processes within a watershed, for use in ecosystem management and project planning. Forest Plan Appendix J characterizes watershed analysis from an aquatic perspective.

Water table The upper surface of the ground water or that level below which the soil is saturated with water.

Well-drained soils Water is removed from the soil readily, but not rapidly.

Wetlands Areas that are inundated by surface or ground water with a frequency sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include peatlands, muskegs, marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs.

Wild and Scenic Rivers Rivers or sections of rivers designated by congressional actions under the 1968 Wild and Scenic Rivers Act. Wild and scenic rivers may be classified and administered under one or more of the following categories:

Wild River areas Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

Scenic River areas Rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Recreational River areas Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Wilderness Areas designated by congressional action under the 1964 Wilderness Act or subsequent acts. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature, with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historic value as well as ecologic and geologic interest. On the Chugach National Forest, a Wilderness Study Area was designated by ANILCA.

Wildland fire (Wildfire) Any wildland fire not designated and managed as a prescribed fire within an approved prescription. All wildland fires will be given an appropriate suppression action.

Wildlife analysis area A division of land used by the Alaska Department of Fish and Game for wildlife analysis (WAA).

Wildlife habitat improvement projects Projects that provide more favorable habitat condition for wildlife including, structural and non-structural habitat improvement projects such as: prescribed fire, willow cutting, aspen harvests, fertilization, nest islands, road obliteration, interpretive signing, interpretive facilities, and wildlife viewing facilities.

Windfirm Trees not likely to be blown over by the wind. These are usually trees that have been exposed to the wind throughout their life and have developed a strong root system or trees that are protected from the wind by terrain features or other trees.

Windthrow The act of trees being uprooted by the wind. Sitka spruce and hemlock trees are shallow rooted and susceptible to windthrow. There are generally three types of windthrow - endemic where individual trees are blown over; catastrophic where a major windstorm can destroy hundreds of acres; and management related, where the clearing of trees in an area make the adjacent standing trees vulnerable to windthrow.

Windthrow management area A managed area designed to minimize windthrow within an adjacent no-harvest area.

Winter range An area, usually at lower elevation, used by big game during the winter months; usually smaller and better-defined than summer ranges.

Winter use period Recreational use during the winter months, generally the Wednesday before Thanksgiving until April 30.

Withdrawal The withholding of an area of federal land from settlement, sale, location, or entry under some or all of the general land laws for the purpose of limiting activities under those laws in order to maintain other public values in the area.

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